

POPULAR SCIENCE

March
15¢

M O N T H L Y
Mechanics & Handicraft

SEE
PAGE
129

HOME WORKSHOP :

*143 Things
to Make*

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Of 22 Important Features Found in High-Priced Cars... PLYMOUTH has 21...CAR "2" has 11...CAR "3" has 8

THIS YEAR, high-priced cars resemble each other in 22 important quality features. But of "All 3" low-priced cars only Plymouth gives you a majority of these features.

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PLYMOUTH BUILDS GREAT CARS

POPULAR SCIENCE

Founded 1872

MONTHLY
Mechanics & Handicraft

Volume 136, No. 3

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CONTENTS FOR MARCH 1940

World Sky Terminal.....	59
Be Your Own Weather Man.....	65
Hot Stuff on Ice.....	76
Can Mines Conquer Sea Power?.....	78
Sherlock Holmes of Furs.....	84
Snake Myths Smashed by Science.....	90
How Our Navy Trains Its Divers.....	98
G-Men of the Fields.....	108
Workshops for Rent.....	116
Making of an Army Flyer.....	120

Features and Departments

OUR READERS SAY—.....	12
IDEAS FOR HOME OWNERS.....	30
THE MAN WITH THE NET.....	131
NEW HOUSEHOLD APPLIANCES.....	132
POPULAR SCIENCE QUESTION BEE.....	138
UN-NATURAL HISTORY.....	139
GUS WILSON'S MODEL GARAGE.....	140
AMATEUR PHOTOGRAPHY.....	194
NATIONAL HOMEWORKSHOP GUILD.....	199
ADVENTURES WITH YOUR MICROSCOPE.....	206
HOME-LABORATORY CHEMISTRY.....	209
RADIO DEPARTMENT.....	212
USEFUL HINTS FOR MOTORISTS.....	220

AUTOMOBILES

Coal Gas Used To Drive Car.....	88
Chains Built into Tire.....	88
Tester Detects Wheel Wabbles.....	89
Screw Driver Sets Tappets.....	96
Device Gives New Oil for Old.....	114
Crash Truck Salvages Planes.....	115
Panel Checks Electric System.....	115
Truck Springs Use Plane Tires.....	117
Inner Tube Cushions Luggage.....	218
Radiator Screen on Roller.....	218
Mark on Handle Guides Jack.....	218
Balsam Hides Windshield Cracks.....	220
Cigarette Smoke Locates Leaks.....	220
Strap Helps Remove Headlamp Rims.....	222
Compass Test for Battery.....	222

AVIATION

Pup Aids Pilot in Take-Off.....	89
Parachute Attack Gets War Test.....	107
Flyers Trained To Shed 'Chutes.....	113
Weatherproofing Ocean Planes.....	125
Fog "Eye" Reveals Ground.....	128
One-Man Helicopters for War.....	129
Blimps Fitted for Sea Rescues.....	134

HEALTH AND HYGIENE

Lamp Shows Inner Eye.....	102
Whittles To Soothe Nerves.....	114
New Test Aid for Doctors.....	114
Two-Spoon Medicine Doser.....	129

HELPS FOR HOME OWNERS

Remote Control for Water Heater.....	30
--------------------------------------	----

(Continued on page 4)

THE HOME WORKSHOP begins on page 143

Published monthly at 353 Fourth Avenue, New York, N. Y., by Popular Science Publishing Co., Inc. Godfrey Hammond, President and Treasurer; R. C. Wilson, Vice President; Raymond J. Brown, Vice President; F. W. Briggs, Secretary. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada, Printed in U.S.A. Copyright, 1940, by Popular Science Publishing Co., Inc. All rights reserved in the United States, Great Britain, and in all countries participating in the International Copyright Convention and the Pan American Copyright Convention. Single copy, 15 cents. Yearly subscriptions to United States, its possessions, and Canada, \$1.50; foreign countries, excepting Canada, \$2.50. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address. The contents of this magazine must not be reprinted without permission. The editors are not responsible for unsolicited contributions, and cannot guarantee the return of such material or insure against its loss. Contributions not accompanied by sufficient postage will not be returned. In presenting numerous stories of new products of applied science, Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. To avoid liability for patent infringement, readers should investigate before making, using, or offering for sale any of the devices, machines, or processes described; Popular Science Monthly takes no responsibility. The use of Popular Science Monthly articles for stock-selling schemes is never authorized.



the Case of the Crying Wife

1 Ann doesn't cry easily—but that night I found her in tears! "I can't help it," she sobbed. "All the things we were going to do—buy a car, build a home—remember? And here we are—married three years, and just barely making ends meet! I thought our dreams might come true—but it's no use." I made up my mind right then to "have it out" with the boss.



2 "Look here!" he said. "I can't pay you more unless you're *worth* more! And frankly, John, you lack the *training* a bigger job needs. Ever hear of the International Correspondence Schools?"



3 When I learned the boss was a former I.C.S. student, I signed up *quick*! And what a difference it made in my work! I'd never realized until then how *little* I knew about the business.



4 I'm happy, and Ann's happy, and I guess the boss is happy. (At least I've had two "raises" in the last year!) And here's the very same coupon that I mailed, staring you in the face!

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CONTENTS [Continued]

Novel Bulb Gives Three-Way Light....	30
Electric Heater Oscillates.....	30
Revolving Bolt and Screw Rack.....	32
Door Knocker Sounds Chime.....	32

HOUSEHOLD AIDS

Nonskid Spray for Bathtub.....	132
Ring-Shaped Cake Cutter.....	132
Floating Water-Lily Candle.....	132
Egg Poacher Fits on Saucepan.....	132
Ventilator for Kitchen.....	132
Electric Cooker Bakes Biscuits.....	133
Shelf Swings Under Sink.....	133
Socks Mended Without Sewing.....	133
Extinguisher Quenches Thirst.....	133

NEW INVENTIONS

Belts Made of Coal and Salt.....	75
Children Build Tunes with Kit.....	89
Soot Trap Launderers Smoke.....	95
Watch Crystals Melted into Place.....	95
Emergency Shower for Workers.....	96
Planer Fits on Drill Press.....	104
Poles Pulled Out of Concrete.....	106
Comb, Brush, Curler, in One.....	106
Starters for "Frozen" Nuts.....	112
Civilian Designs Gas Mask.....	113
Wall Chart Shows Child's Growth.....	118
"Mechanical Kisser" Tests Lipstick....	118
Red-Hot Wire Cuts Silhouettes.....	118
Artificial Flowers Can Be Washed.....	125
Two-Purpose Paper Weight.....	126
Safety Lifeboat Can't Swamp.....	127
New Gauge for Locomotive.....	128
Electric Merry-Go-Round.....	129
Transparent Face Mask.....	130
Mower Uses Rotating Disks.....	130
Metal Edges for Skis.....	131
Three-Way Machine-Tool Vise.....	131

PHOTOGRAPHY

Puts Voice into Home Movies.....	124
Flash-Gun Reflector Holds Cells.....	136
Kitchen-Door Darkroom Outfit.....	136
New Color-Photo Printer.....	137
Enlarging Paper Fits Fan's Wants....	137
Triple-Firing Flash Gun.....	137
Print Washer Resembles Book.....	137
Printing Photos on Any Material.....	194
Small Jets for Washing Prints.....	196
Restoring Hypo-Stained Negatives....	196
Box for Loading Film in a Reel.....	197
Black Felt Kills Reflections.....	197
Chemical Reduction Formulas.....	197

Taped Shutter Can't Be Tripped.....	198
Holder for the New Photofloods.....	198
Extension Legs Lift Tripod.....	198
Reflectors Shielded with Cards.....	232
Rubber Band Improves Tripod.....	232
Toothpick Swab Applies Fluid.....	232
Candid Shots with a Box Camera.....	234
Testing White Photo Powders.....	234

RADIO

Portable Two-Way Radio.....	75
Set Has Band-Spread Dial.....	212
Three-Way Portable Receiver.....	212
Glass Makes Resistors Flexible.....	212
Tiny New Loudspeaker.....	212
Display Shows Radio Troubles.....	213
Speaker Weighs 500 Pounds.....	213

UNUSUAL FACTS AND IDEAS

Ships Get Bomb Shelters.....	73
Cocktails? Just Tune Them In.....	73
"Fireworks" in Army Maneuvers.....	74
Cookies Patterned After Pets.....	74
Swimmers Form Human Pin Wheel....	87
Stamps and Map Decorate Screen.....	87
Hobbies Create Amateur Museum.....	94
Traveling Fire-Fighting Exhibit.....	94
Helmets Get Chain-Mail Visors.....	95
Luminous Spray for Hair.....	96
Artist Makes Miniature Miniatures...	97
Coats of Arms Depict Hobbies.....	102
Well-Bred Parrot Uses a Spoon.....	102
Can Do! (Poem).....	103
Houses from Grape-Picking Boxes....	104
Chart Helps Select Neckties.....	106
Rubber Gown Is Blow-Out Attire.....	112
Cereal Package Has Five Kinds.....	112
Church Services in Sound Movies.....	119
Monster Unearthed by Steam Shovel..	126
Yam Weighs Twenty-Six Pounds.....	128
Artist Paints with Spray Gun.....	130
Dare-Devil Ride Tests Aqueduct.....	135
Comic-Face Kit Provides Fun.....	135
"Quake" Waves Spot Guns.....	135

CRAFTWORK

Gay Memo Pad Brightens Kitchen.....	149
Tom-Tom Made from Old Nail Keg....	150
Rack Holds Top of Coffee Maker.....	155
Candle Snuffer of Simple Design.....	158
Whatnot Shelves Cut on Jig Saw.....	159
Garden Markers Made of Wood.....	172
Chickadee Acts as Shade Pull.....	173

(Continued on page 6)

In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions



"YOU'RE TELLING ME!"

"That's a funny one. You're telling me what a great thing the telephone is. As if I didn't know!

"Why, I'm one of the main reasons there's a telephone in our house. For you can bet your life I keep the folks pretty busy around here.

"Just think! If we didn't have a telephone, we couldn't order things in a hurry from the stores. And Grandma couldn't call up to ask if I had a new

tooth. And my Daddy couldn't talk to us when he is out of town. And Mother would be tied down just something awful.

"And suppose one of us suddenly took sick? Or there was a fire? Or a robber, maybe? Well, I don't worry about those things when I see the telephone.

"Doesn't cost much either,' my Daddy says. And Mother says, 'I don't know what I'd do without it.' "

BELL TELEPHONE SYSTEM



CONTENTS [Continued]

Tiny Hawaiian Basket and Pups.....	186
Initial Book Ends Made of Pine.....	203
Dog's Buffet Holds Three Dishes.....	203
Casting Dogs' Drinking Basins.....	204

HINTS FOR THE HANDY MAN

Eye-piece Turret for Telescope.....	148
Brushes Suspended in Keeper.....	149
Sacks Tied with Wire Solder.....	149
Name in Marbles Set into Mat.....	150
Narrow Tape Forms Neat Joints.....	150
Pinhole Enlarges Small Print.....	151
Rubber Holder Adjusts Drop Cord.....	151
Metal Shield for Paint Burning.....	155
Pedal Controls Mount for Motor.....	155
Valve Used for Grinding Glass.....	155
Magnifier Aids in Filing Saws.....	158
Substitute for a Piano Hinge.....	158
How Much to Round Off a Gouge.....	158
Solder Bits Saved for Odd Jobs.....	158
Strips of Inner Tube Grip Work.....	159
Benzine Cleans Tracing Cloth.....	159
Ink Fountain Inserted in Plate.....	159
Keeping the Home Shipshape.....	162
Bench Rack Holds Hand Grinder.....	168
Jig-Saw Blades Kept in Bamboo.....	168
Plug Reverses Motor Connections.....	168
Bicycle Powered by Small Motor.....	169
One Man Operates a Two-Man Saw....	170
Fan Blows Dust from Table.....	170
Router Acts as a Surface Gauge.....	170
How to Apply Glue to Overlays.....	170
Disks Hide Unsightly Screws.....	171
Scale Cemented to Tailstock.....	171
Emery Keeps Cutter from Slipping.....	171
Easy Way to Apply Soldering Acid....	171
Support for Typewriter Paper.....	173
Holding Delicate Parts in Vise.....	173
Pipe Cleaners Remove Cuttings.....	178
Ammonia Bleaches Iodine Spots.....	178
Substitute for a Rubber Stamp.....	178
Reflectors for Dog at Night.....	179
Tank Farming on a Small Scale.....	180
Using Pantograph on Small Table.....	181
Ignition Cord Improves Scale.....	181
Small Saddlebag Holds Tools.....	202
Book Cover Padded with Rubber.....	202
Plans Waxed to Prevent Sticking.....	202
Outlet Hides Clock Connections.....	202
Pads Improve Drafting Triangle.....	202
Finger Coil for Paint-Pail Hook.....	203
Resharpening a Cutter Wheel.....	204
Magnetized Punch Holds Brads.....	205
Flash Light Fastened to Head.....	205
Foil Preserves Paintbrushes.....	205
Shop Sayings of Old Bill.....	226

HOME LABORATORY

Coffee Stove Heats Small Flasks.....	205
Stereo Photos with a Microscope.....	206
Research Chemistry at Home.....	209

MODELS

Models Train Basketball Players.....	73
Gasoline Runs Tiny Autogiro.....	75
Imitation Earth for Roadbed.....	88
Fans Run Large Railway System.....	105
Model Plane Tows Advertisement.....	119
Orchestra Model Teaches Music.....	124
Realistic Oceans for Ships.....	126
How to Build a Midget Racer.....	144
Toothbrush Gives Rubbed Finish.....	150
Track Gauge Spaces Model Ties.....	160
It's Fun to Build Ship Models.....	228

NEW SHOP IDEAS

Accessories for Drill Press.....	168
Special Picture-Frame Clamps.....	179
Bar Clamps Easily Improvised.....	179
Electric Finder Locates Pipes.....	187
Cleaning Soot from Stovepipes.....	190
Screw Cleans Grease from Gears.....	190
Setting Over a Lathe Tailstock.....	190
Toothed Chuck Dogs Grip Work.....	190
Wax Fastens Pattern to Metal.....	190
Don't Throw Away Your Old Drills....	191
Keeping Tailstock from Binding.....	192
Chuck Holds Rods for Threading.....	192
Reference Data Kept in Frame.....	192
Simple Jig for Cutting Circles.....	192
Trick Way to Cut Tenons on Saw.....	193
Clamps Make Faceplate Straps.....	193
Flattening Inaccessible Rivets.....	193

SHOP DATA FILE

Spreading Rates for Paints.....	154
Boring with Auger Bits.....	160
Protective Coating for Walls.....	166
Repairing Electric Door Openers.....	169
Circular-Saw Tenoning Jig.....	177
Chemical Reduction, Part I.....	197
Chemical Reduction, Part II.....	198

WOODWORKING

Miter Box Gives Variety of Cuts.....	150
Bronco Toy Thrills Children.....	151
Cabinets Modernize Old Bathroom.....	152
Jacobean-Style Bedside Table.....	156
Tilting Cabinet Holds Chisels.....	161
Better Ways to Do Lathe Sanding.....	164
Portable Desk for a Boy's Room.....	167
Table Has Rolling-Pin Legs.....	173

RADIO

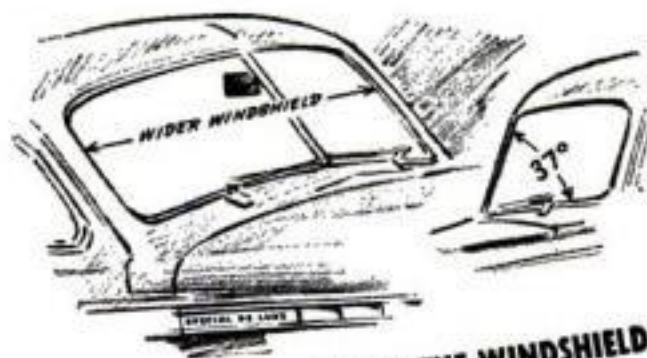
New Set Has Band-Spread Dial.....	212
A Three-Way Portable Receiver.....	212
Glass Resistors Are Flexible.....	212
Tiny Permanent-Magnet Speaker.....	212
Loudspeaker Weighs 500 Pounds.....	213
Display Shows Radio Troubles.....	213
Combination Cane-and-Seat Radio.....	214
Cabinet Ideas for Radio Builders.....	216

NOTES FROM A
CRAFTSMAN'S HANDBOOK

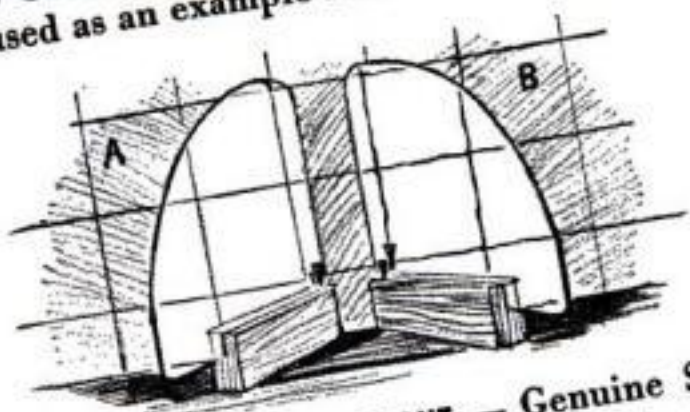
PLANNED VISION

in the 1940 BODY BY FISHER

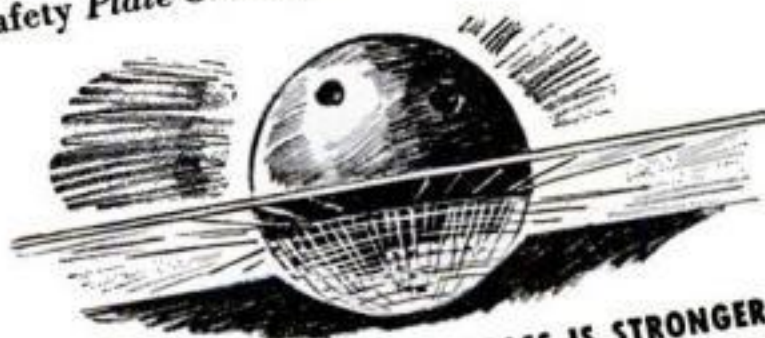
The improvement of visibility involves a number of considerations — namely: the size of the glass areas, the use of distortion-free glass, and the angle at which the windshield is set. The 1940 Body by Fisher brings notable advances in each of these respects to each of the new General Motors cars. The new Chevrolet is used as an example here.



MORE WIDTH, MORE RAKE TO THE WINDSHIELD — With the wider windshield, the driver's area of vision is considerably increased. With the windshield slanted 37°, glare is effectively reduced and overhead traffic signals are brought more readily into view. Similarly, improved positioning of the rear-view mirror and a 10% larger back window of curved Safety Plate Glass give a better view rearward.



CLEARER VISION THROUGHOUT — Genuine Safety Plate Glass (A) entirely eliminates the distortion waves produced by ordinary Safety "window" or laminated sheet glass (B). Furthermore, tests show that this distortion-free glass reduces eyestrain 62%, greatly minimizes driving fatigue. The new Body by Fisher provides this better visibility for all passengers, through all glass areas, even in the lowest-price models.



NEW HI-TEST SAFETY PLATE GLASS IS STRONGER — Newly developed Hi-Test Safety Plate Glass is much stronger than previous types, actually cushions the blow. A 16-lb. bowling ball, dropped from a height of 6', fails to penetrate — is held in suspension by the plastic. This stronger, safer glass is used not only in the windshield — but in all door windows and Ventipanes of the 1940 Body by Fisher on the Chevrolet sedan pictured on this page.

They're saying, "Chevrolet's First Again." And there are a host of reasons why in its new Body by Fisher. In this Chevrolet Special DeLuxe sedan, for instance, you'll find more room than ever before and the stronger, safer, new Hi-Test Safety Plate Glass is not only in the windshield—but in all door windows and Ventipanes, as well.



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Simple Inventions, Improvements, Often Big Commercial Successes

Inventions need not be complicated to be successful. Many outstanding successes have been made by simple devices. The zipper, thumb-tack, collar-button, safety-pin, paper clip, etc.—and methods of making them—have proved profitable to their inventors. The overall buckle is said to have made a fortune for its inventor. Remember, too, that patents are granted on improvements over already-existing inventions. You can secure a Patent for such an improvement, even though you do not hold the patent on the original invention. Sometimes improvements—as was the case, for example, with the zipper—are more valuable than the orig-

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TOPTON, PA.



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Radio broadcasting stations employ engineers, operators, technicians. Radio manufacturers employ testers, inspectors, foremen, servicemen in good-pay jobs. Radio jobbers, dealers, employ installation and service men. Many Radio Technicians open their own Radio sales and repair businesses and make \$30, \$40, \$50 a week. Others hold their regular jobs and make \$5 to \$10 a week fixing Radios in spare time. Automobile, police, aviation, Commercial Radio; loudspeaker systems, electronic devices are other fields offering opportunities for which N.R.I. gives the required knowledge of Radio. Television promises to open good jobs soon.

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The day you enroll, I start sending you Extra Money Job Sheets which start showing you how to do Radio

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Dear Mr. Smith: Send me FREE, without obligation, your 64-page book "Rich Rewards in Radio" which points out Radio's opportunities and tells how you train men at home to be Radio Technicians. (Write Plainly.)

Name..... Age.....

Address

City..... State.....

Our Readers Say



Hollywood Has Made That Kind for Years, He Contends

ACCORDING to my newspaper, the long-forecast "movies that smell" have at last become a reality. An audience in Switzerland recently enjoyed (I hope) a motion picture accompanied by olfactory effects which were distributed through the theater by means of a system of "smell aerials"—whatever they may be. If roses appeared on the screen, for instance, the air was filled with the fragrance of the flowers. The report did not state how they would manage a quick change of scene from a garden

HOW ABOUT IT?



to a stockyard. And please tell me what could be worse than trying to respond to the subtleties of Myrna or Hedy in a rose garden, under the pervading atmosphere of earlier scenes in said stockyard. Well, first it was movies; then it was talkies, and now it is smellies. But, judging by some of the films I have seen, giving movies an artificial smell would often be just another case of painting the lily.—R. McC., Kansas City, Mo.

Sounds Like Aladdin's Lamp, but He Doesn't Mention the Jinni

A STRANGE thing happened while I was rebuilding a piano bench into a chest of drawers in my workshop. It puzzled me so much I thought I'd write and see if your readers could figure it out. In taking off the varnish, I used a varnish remover without results, and had to turn to lye to do the job. I then washed it thoroughly and the next evening

H'M, SMOKE, STRANGE!



sanded the job down. The next night I stained it a dark mahogany. Tonight, I put its first coat of varnish on. Here's the point. As I was finishing the back, I noticed a little swirl of smoke coming from under the lid at one corner. It didn't take much of a sniff to convince me that it was real smoke, but I looked in vain to find exactly where it was coming from. What did I do to produce this mystery?—G. E. W., Parkersburg, W. Va.

The Gasoline Makers Needn't Worry for a Little While, Anyway

A. R. P. is just having a brain storm when he suggests running an automobile on the hydrogen and oxygen of electrolyzed water. What he suggests is possible, but a trifle more expensive and extravagant than gasoline, to put it mildly. Either the electrical power would have to come from outside, which would be impractical, or be self-generated, which is perpetual motion. The most likely source of power from water is through disintegration of the H_2O atoms, which is as yet a doubtful possibility. P. S. M. is plenty O.K. I'm a particularly avid radio fan, and soak up all such material you publish. I like the radio plans, although I'll never in a thousand years build all of them.—A. S. B., St. John, Kans.

A New Use for Your Old P. S. M.'s —Paper Your House With Them

FOR four years, I've saved every issue of P. S. M. which I read and reread. I have figured that in another twenty-five and a quarter years I'll have enough to paper our house, and then no matter what room I am in I will be able to enjoy it. Your magazine has meant even more to me since I have been in bed the last seven months. I've honestly got a lot out of it and eagerly await the new copy each month. So please keep up your good work.—D. W. Haverstraw, N. Y.



of it and eagerly await the new copy each month. So please keep up your good work.—D. W. Haverstraw, N. Y.

On the Subject of Bones, He Has a Bone To Pick

IT SEEMS to me that the globe described on page 113 of the January issue for the aid of the blind has other possibilities. For instance, the pins could be taken out and reinserted to conform with the ever-changing boundaries of the European nations. Now I have a bone to pick with The Man with the Net. In his column, he declares that the reason that dogs can digest bones is that their stomachs secrete hydrochloric acid. So what? So that's true, but he neglects to mention that humans also have hydrochloric acid in their insides

(Continued on page 14)



SUCCESS—

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You want these things very much.

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Many men, *knowing* what home-study training under the LaSalle Problem Method can do for them,

nevertheless prefer to think that there's "nothing in it." That's the excuse they make for their futures.

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If on the other hand you have imagination enough to *visualize* your goal—to actually see yourself in a home of your own, enjoying the comforts and luxuries of life—if, in short, you are a man of *purpose*, the coupon below may shorten your journey to success by many years.

Note, please, that the coupon names different lines of training and that it will bring you full particulars of the training which appeals to you, together with a 48-page booklet discussing the opportunity and requirements of that field—all without obligation.

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Address.....

Our Readers Say (CONTINUED)

but they can't digest bones. Why?—G. H. F., New Paltz, N. Y.

No Trick Was Intended. How About It, "Iowanian"?

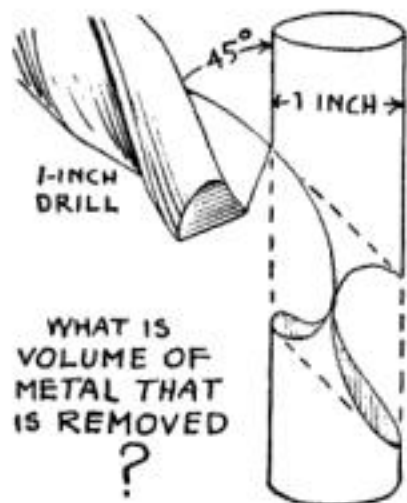
THE answer to the problem submitted by G. H., of Sioux City, Iowa, is that A equals 6.07149 plus inches, which is the same for B, both being equal. The question reads in a tricky "Iowanian" language: "What is the length of A and B, both being equal?" This would mean A plus B, or 12.14298 inches. What I would like to know is the relation, if any, of the geometry problem submitted by G. H. and his comments on the girl drum majors. The geometry problem was all angles while the girl drum majors are all curves, or are they all just angles to G. H.?—H. B. H., Philadelphia, Pa.

JUST VARIETY OF INTERESTS!



Workshop Fans Will Answer This Quick As You Can Say Drill Press

YOUR magazine is a regular habit with me. I never miss Gus Wilson, Old Bill, and the Question Bee. Keep them up, and also Our Readers Say. Here's a problem that should interest the home-workshop fans as well as the mathematicians. If a 1" round bar could be drilled accurately across its axis with a 1" drill on a 45° angle, how much metal would be drilled away? I don't know the answer, but I would like to know it very much.—E. H. W., San Francisco, Calif.



Gullible Electric Eyes Are Fooled by Birds

AS ONE of your veteran readers, I remember an article you published two or three years ago about the "free port," or foreign-trade zone in New York Harbor, where steamer cargoes bound from one foreign country to another can be transshipped without entering the U. S. Customs. You told how electric-eye beams, skimming the surface of the water across the mouth of the port, would guard the wharves against smug-

glers and harbor pirates approaching by boat. When I read the piece, it occurred to me that there might be trouble because other things besides smugglers can interrupt a light beam. Now I hear that my hunch was right. They say that the special guards at the port are kept on the run day and night by sea gulls that fly across the beams and set off the alarms. Nothing can be done about it, I suppose, unless they can develop a breed of transparent sea gulls.—S. B., Stapleton, N. Y.

He Likes His Melons and Liquor Served Separately, Please

THOSE liquor-fed melons which are said to have a superior flavor are interesting as an experiment. But what I want to know is by whose taste the flavor is supposed to be so good. Here's hoping the experiment will proceed no further. Not that I'm an abstainer from the products of either the grape or melon vines. It just happens that I like both my liquor and my melons "straight." And though I haven't tasted the combination, I don't want to.—B. R. E., Hartford, Conn.

YEAH, THEN ASK ME FOR SOME MIXTURE I NEVER HEARD OF!



Spooks Among the Spokes Have This Reader Puzzled

HAVE seen many spirit photographs in my day, but the one published in your January issue beats them all. May I refer you to the picture of the Russian cyclist on page 116. Could you please tell me who that very interesting-looking fellow "hanging in suspense" near the cyclist's head is? Maybe it is the head belonging to that pair of flat feet over in the right-hand corner. Any light thrown on the matter would be appreciated.—C. M., Baltimore, Md.



Some Like It Hot; Some Cold. Most of 'Em Just Say Phooey!

PROBABLY O. T. F. will save fuel if he lets his house cool off at night. The problem he's faced with is determining just how much it should cool, as I see it. Normally, the outdoor temperature is colder at night than during

(Continued on page 16)

FINED FOR IGNORANCE!

Don't Let It Happen to You!

The average grade school graduate earns \$16.30* a week less than high school graduates earn.

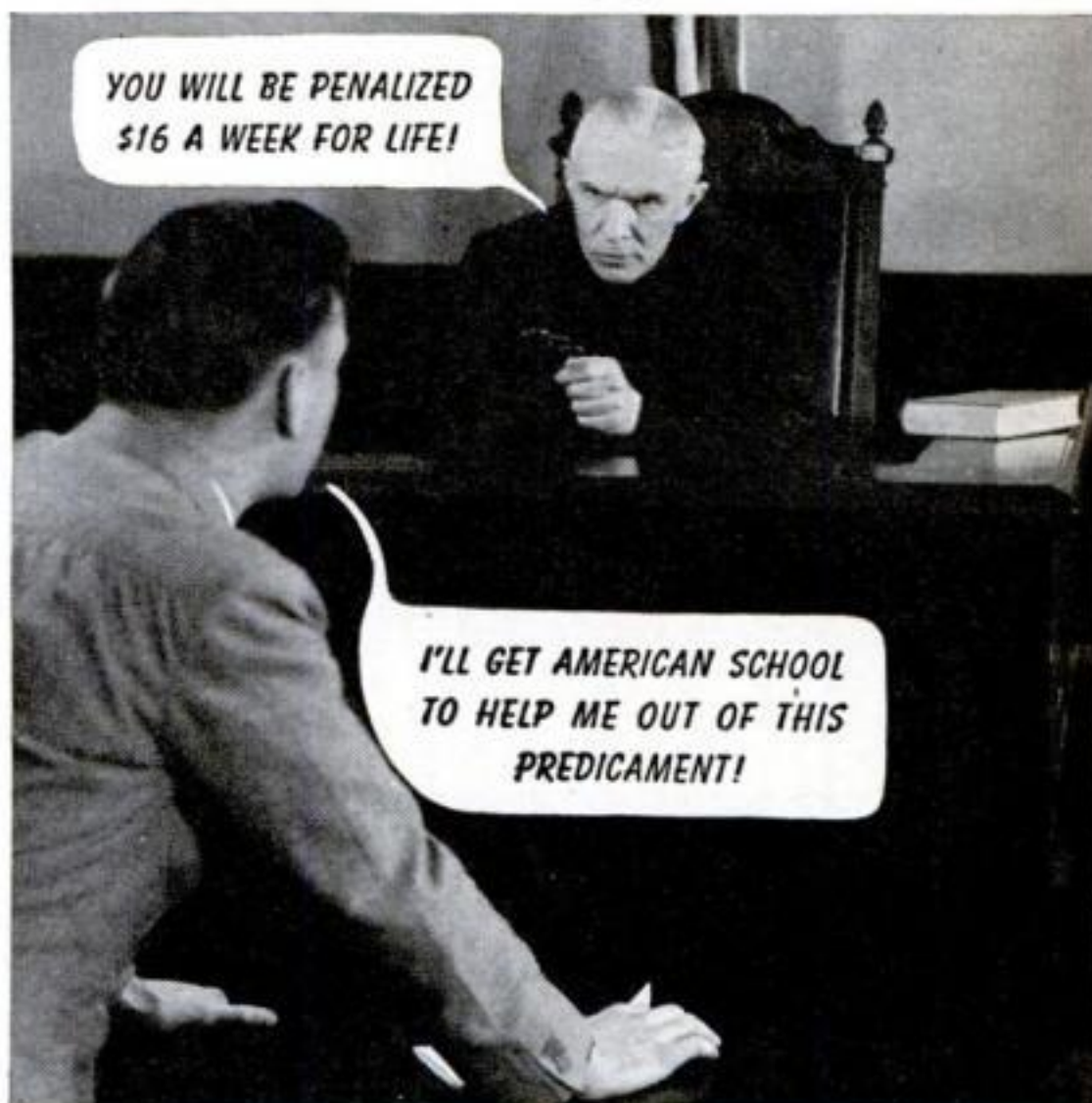
The average high school graduate earns \$25.25* a week less than do men with college or vocational training.

*Figures computed from Government report. For basis of computation, write American School.

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Up to**

\$40 a week*
EXTRA
income

Study at HOME!



You Too Can Win a Better Job!

HAVE YOU thought about *home study*? You look around you at your friends, neighbors and fellow employees: This one earns \$10 a week more than you—that one earns nearly double—a third, though appreciably younger than you, seems to be making better progress. Why? How can you catch up with them? You know that literally *thousands* of ambitious men and women have won substantial Success through using their spare time at home to master the principles and practice of their chosen lines. How can HOME STUDY help you make good?

The "Magic" of Home Study

There's no magic to home study. It's hard work—but it is *worth* the effort because it helps you overcome the handicap of having left school too soon. It frees you from the penalties of Ignorance—enables you to compete to better advantage in this NEW world of *college trained* men and women.

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Our Readers Say

(CONTINUED)

the day. It therefore requires more fuel to maintain the temperature in a house at a given level, say 72° F., at night than during the day. If he wanted to attain utmost fuel efficiency, he would have to work out a complicated equation based on (a) the heat-radiating properties of his outside walls, his windows, and his roof; (b) day-and-night differential of mean temperatures during the winter months in his region; (c) radiant efficiency of his heater; (d) anything else he could think of, including the cooling effect of his refrigerator and the blood temperature of his goldfish. Most people just say phooey to all this, and set their thermostats at about 64° just before they go to bed. These people have been found by investigators to sleep soundly and dream pleasant dreams.—L. H., Minneapolis, Minn.

Well, Those New-Model Radios Are Not Obsolete Quite Yet

It's recently been brought to my attention that all mammals below the primates—in other words, any mammal but man and the apes, monkeys, marmosets, and lemurs—are color blind. As a dabbler in evolution, I was

SOME BROADCAST THEIR FAVORITE PROGRAM, OTHERS JUST LOOK IN THE MIRROR



wondering if this might not prove something under Darwin's scheme of things. You see, the lower orders of living things are not yet sensitive to the minor variations in light wave lengths that we perceive as color variations. As time goes on, isn't it possible man may become still more acutely sensitive to ultrashort

waves—perhaps of the radio type—so that he may be able to tune in on his favorite broadcasts without benefit of a complicated receiving set?—W. M., Seattle, Wash.

The Light Pattern Resembled the Tennis Net's Outline

P. H., of Eureka, Utah, didn't see a shadow lighter than the surrounding area. Here's what did happen. The sun was situated at the proper angle so as to increase the size of the shadow cast by each string of the tennis net. These enlarged shadows were so wide that the remaining pieces of light-covered ground were very thin—perhaps no wider than the diameter of the string used in the net. To prove my solution, stand a piece of ordinary window screening on a flat surface much as the net would stand. By manipulating a piece of paper on the side where the shadow falls, you may attain just the right amount of shadow to make it appear as

(Continued on page 18)

though the screen is casting a shadow of light. By the way, I believe the theory of J. J., of Bridgeport, Conn., about the appearance of steam over the boiling pot on the gas range can be improved. How about the heated air from the gas flame allowing little cool air to come in contact with the vapor rising from the kettle? It was condensed gradually and remained invisible. The moment you shut off the flame, the cooler air struck the vapor, the immediate result being a rapid condensation and visible steam. Incidentally, I certainly get a big kick out of your readers' letters, as you have probably guessed already. They make you want to sit right down and answer them.—J. A. W., Chicago, Ill.

Now It's Time To Hear from the 128,999,999 Others

THE situation described by W. P. H., of Mt. Sterling, Ky., not only interests me, but I find it very amusing. I don't take much stock in his story about the sun "cutting capers," as the heading put it. May I suggest that W. P. H. see an optometrist? Before making fantastic statements like that he should bear in mind that it's his word against that of 129,000,000 keen-eyed Americans, which includes many downright good astronomers.—A. R. P., Exeter, Pa.

SAY! YOU KNOW SOME PEOPLE SEE PINK ELEPHANTS AND THINGS !!



A Cavalryman's Grandson Says It Can't Be Done

WITH the recent release of the long-awaited movie version of "Gone with the Wind," the newspapers have been trotting out a lot of more or less interesting facts about the book, its author, and the period it describes. Most of these tales are at least within the bounds of reason, but I saw one today that is absolutely incredible. It said that Margaret Mitchell, the author, got the inspiration for the book when, as a child, she would sit on the laps of former Confederate cavalry officers. Did you ever try to sit on a cavalryman's lap? He doesn't have any. My own grandfather rode with Joe Wheeler, and I distinctly remember my childhood efforts to sit on his lap. I'd as soon

G'WAN, WE HAVE TWO LAPS, THAT'S ALL!



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17



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Please send me free and postpaid your large sample tube of ☐ Listerine Shaving Cream; ☐ Listerine Brushless Cream. (Check whichever is desired.)

Name _____

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Our Readers Say—

(Continued from page 16)

try to sit in an automobile tire. You've heard the old gag: "Where does your lap go when you stand up?" Well, the same thing happens when a man joins the cavalry—only in that case it turns out to be permanent.—J. B. B., Nashville, Tenn.

A Tip on a Frosty Subject To Put A. M. J. Straight

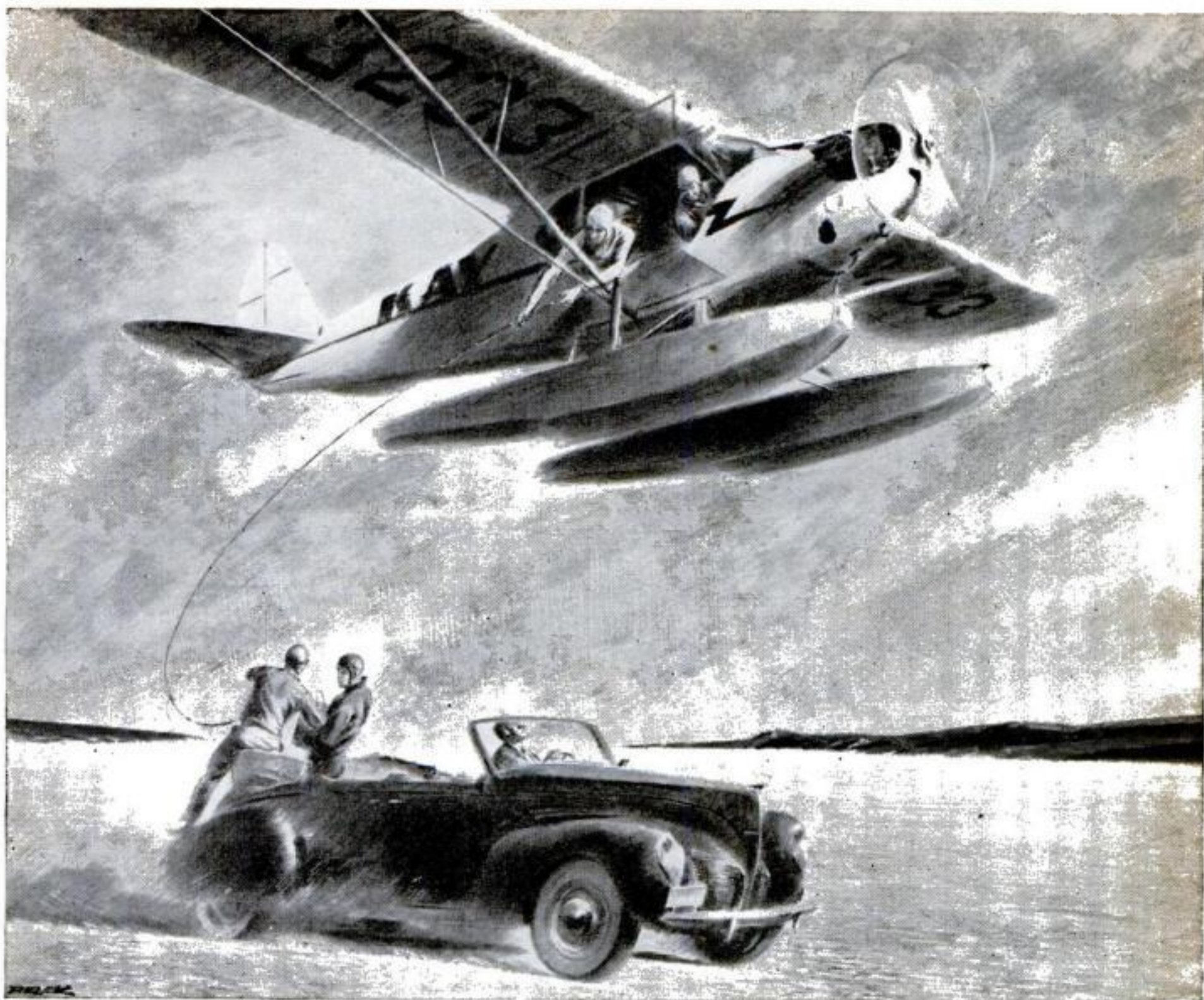
SOMEBODY ought to tip off A.M.J., of Dayton, Ohio, who does not seem to know that frost is not frozen dew. Frost is the result of condensation on a body whose temperature is below the freezing point. The vapor in air changes directly to a solid with no apparent intervening liquid state. The surface temperature of the ground must be at or below the freezing point in order for frost to form. This also explains the formation of frost on a cocktail shaker, as the shaker is filled with ice. If A.M.J. can get an accurate measurement of the temperature of his lawn and not the air, I'm sure that he will find this is true. He might try it by sticking a thermometer into a nail hole in the ground, then taking a reading.—R.C.R., Newark, N. J.

Now If Hollywood Takes It Up We Can All Sop Without a Blush

IN THE February issue of your magazine, I was particularly interested in what B.G., of Boston, Mass., had to say about the revival of the age-old custom of sopping. Coming, as it did, from the cultural and intellectual center of the U.S.A., I feel encouraged to stand up and speak right out in meeting, even though I am just a roughneck. Out here in California, we have a new game that bids fair to become a national pastime. It is eating "chicken au natural." It is simply this: The chicken is prepared and served out in the open. The participants sit on wooden benches at rough board tables minus tablecloths, knives, forks, and spoons. At the words "Go to it!" each one grabs a piece of chicken in one hand and pushes it in the direction of his mouth while, with the other hand, he grabs a piece of bread and sops it in the gravy. When they have finished, they lick their chops and suck the grease from their fingers. Now that this back-to-nature movement is well on its way, I suggest, as a battle cry: "Aw, be yourself!"—G.E.W., Highland, Calif.

And This Fellow's Wish Is Answered on Page 144

WAS very glad to see your article on model racing cars. Now I wish you'd run an article on how to build one. I am not much interested in racing, but I want to radio-control one after the war ends and I get my amateur license back.—S.M.I., Berwick, Nova Scotia.



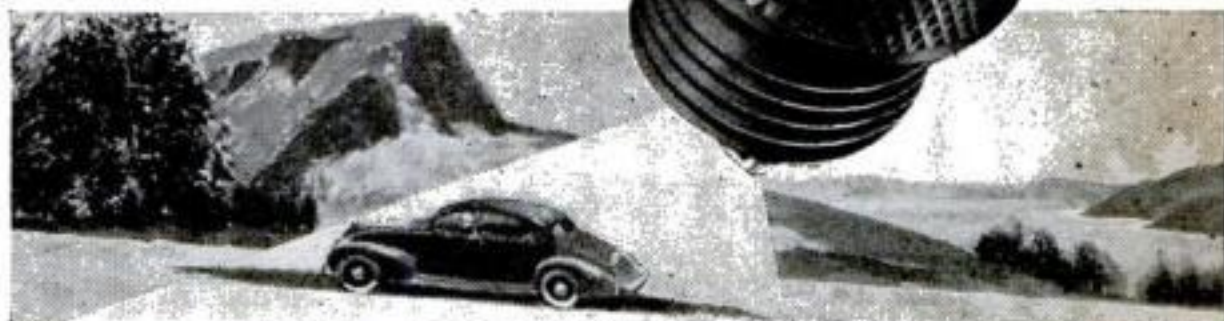
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a new Class IS endurance record for light land planes of 535 hours.

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SOUND EQUIPMENT Page 55

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With the Inventors

AUTOMOBILE THIEVES will get the shock of their lives when they try to snatch cars equipped with an electric protective system worked out by John L. Osgood, a Buffalo, N. Y., inventor. When the owner leaves his car parked, he snaps a switch that sets up a high-voltage, low-amperage, broken electrical circuit through



all metal parts of the car. If a thief should touch the handle of any door, his body would complete the circuit, giving him a potent but harmless shock. The owner protects himself from getting a dose of his own medicine by using an insulating means to unlock and open the car when he returns. The protective system is powered by the car battery and employs an induction coil to step up the battery voltage . . . **MORE THAN 4,000 DESIGN PATENTS** are now issued each year. This is double the rate that prevailed five years ago . . . **FLASH LIGHT AND MAGNIFYING GLASS** are combined in one unit invented by Erwin Eichenberger, of Detroit, Mich. Attached to the frame at the bulb end



of the light, the magnifying lens can be swung outward to enable the user to see a magnified image of whatever object is illuminated by the flash light. One valuable use suggested by the inventor for his brain child is in reading gas and electric meters, which are often placed in dark corners and whose numbers or dials are generally small

. . . **PATENT 2,181,595**, ISSUED TO Wesley Gordon Bruce, of Dallas, Tex., is dedicated "to the free use of the people in the territory of the United States." The patent cov-

(Continued on page 24)

ers a trap for ridding cows, horses, and other livestock of flies and other insects . . . **CARRYING A PASSENGER ON THE HANDLEBARS** of a bicycle is a dangerous practice, since it distributes weight unevenly between the wheels and seriously interferes with steering. To overcome this, Gustav H. Mieher, of Carlinville, Ill., devised an odd bicycle with a front-wheel drive and rear-wheel steering. The cyclist rides on a seat over the rear wheel which is steered by means of handlebars positioned in the center of the bicycle. Although the vehicle is pedaled in the ordinary way, the drive chain runs forward to the fixed front wheel, over which is mounted a seat for a passenger. The odd bicycle is also equipped with a set of gears controlled by a shift lever placed below the handlebars . . . **MORE THAN 10,000 PATENT APPLICATIONS** are refused by Patent Office officials every year . . . **WHIZZING BACK AND FORTH** at high speed, the blade of a new power-operated knife slices through materials quickly and evenly with no effort on the part of the user. When plugged into an electric socket, a motor built into the handle of the knife whirls a wheel whose circular motion is



changed into back-and-forth movements of the knife blade by means of a small connecting rod fastened near the wheel rim. The electric knife, invented by Clem E. Kosterman, of Racine, Wis., should prove especially useful in the home as a kitchen tool for slicing bread, meats, and other foods . . . **AUTHORITIES CLASSIFY PATENTS** in

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Interesting examples: Hans Wach, an obscure worker, invented a simple device to utilize exhaust steam on ships. A report states that *already steamship lines have saved more than \$15,000,000 on fuel bills with his invention.* The Department of Commerce has announced that it will test out a new airplane. The inventor states that the average man can learn to fly in a day; that it will travel at the rate of 110 miles an hour and will sell at the price of a cheap automobile. Seattle man invented a robot to go 5,000 feet under the sea and recover millions and millions of dollars worth of gold lying at the bottom of the ocean since the days of the early Spaniards.

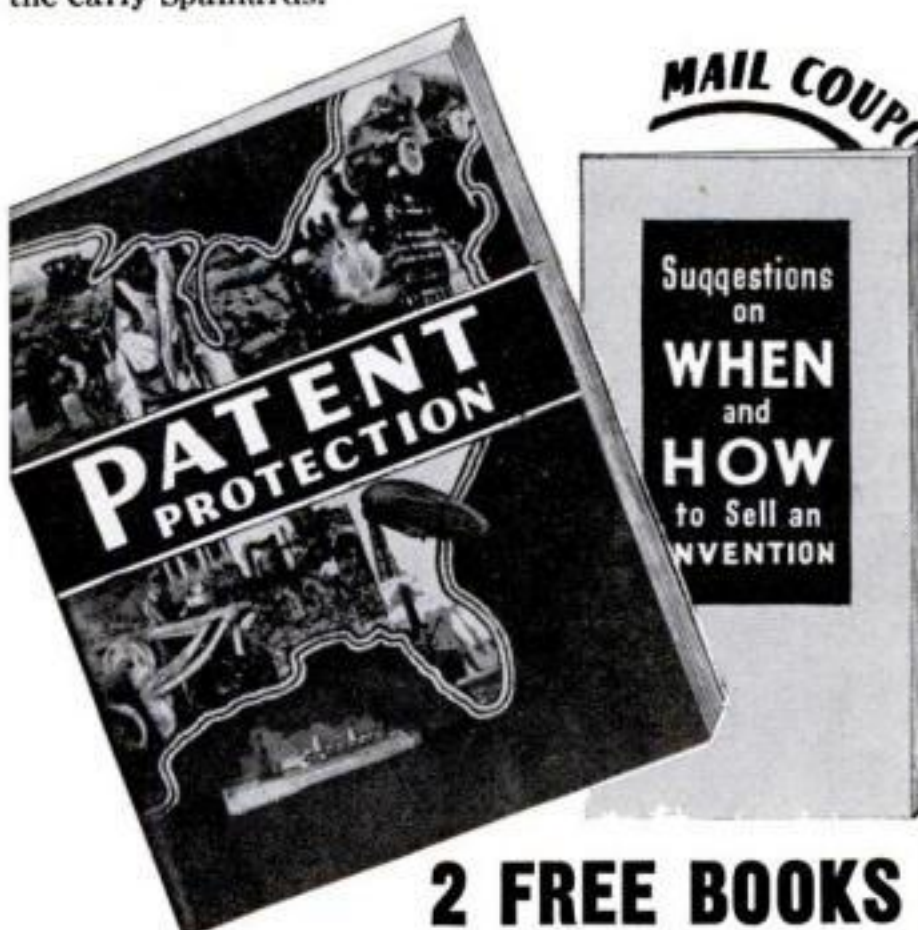
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But remember this: For every outstanding, big invention, there are thousands of small, simple things for use in the home, office, factory, on the farm, on every sort of conveyance. Little articles like you find on the counters of a 10-cent store, hardware store, drug store, toy and novelty shop. A person finds something that doesn't work right, or it's clumsy or costs too much. He gets a happy thought. He improves the old article. That's a contribution to human progress. That's the way that many, many men have reached the goal of financial comfort, independence and even wealth. Most of the things we use today didn't come from the brains of engineers and physicists. They came from the mind and perhaps the crude home workbench of Mr. Average Man, busily engaged in earning his bread and butter at whatever chance or circumstance has given him to do. The "LITTLE" MAN'S OPPORTUNITY AS AN INVENTOR WAS NEVER GREATER THAN IT IS TODAY.

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With the Inventors

(Continued from page 22)

four general types: (1) Mechanical, (2) Compositions of Matter, (3) Processes and Methods, and (4) Design . . . DRAWING A HOT, LUKEWARM, OR COLD BATH is merely a matter of setting two controls and throwing a switch, in a novel automatic water-control system devised by Durell E. Brummett, of Shreveport, La. Mechanical and



electrical means for operating the system are installed in the bathroom wall at the head of a built-in tub, while the controls are mounted on the wall above the tub's water-inlet spout. In a typical use of the apparatus, a bather turns one knob until an arrow on a small dial points to the fraction " $\frac{1}{2}$," twirls a second knob until markings on its face indicate "120," and then throws a switch. Automatically, water at a temperature of 120° F. flows in through the inlet spout, stopping when the tub is exactly half full . . . THIS SHOULD SUGGEST a host of possible "improvements" to wide awake inventors—automatic lathering machines, electrical back scrubbers, robot towellers, and how about adding a timing mechanism, that would automatically start the bath-drawing apparatus at exactly seven o'clock on Saturday night, whether young Willie wanted to soak off the week's dirt or not . . . THERE'S NO REWARD OF A CIGAR if you ring the gong within a curious device developed by Yonai Uchiumi, a Japanese inventor, but the clang will tell



you that you are flexing your abdomen in an approved manner. Designed for use during abdominal breathing exercises, the gong

(Continued on page 26)

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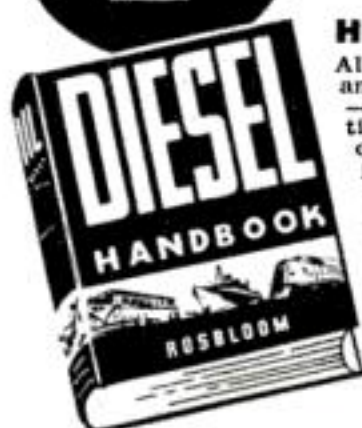
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(Continued from page 24)

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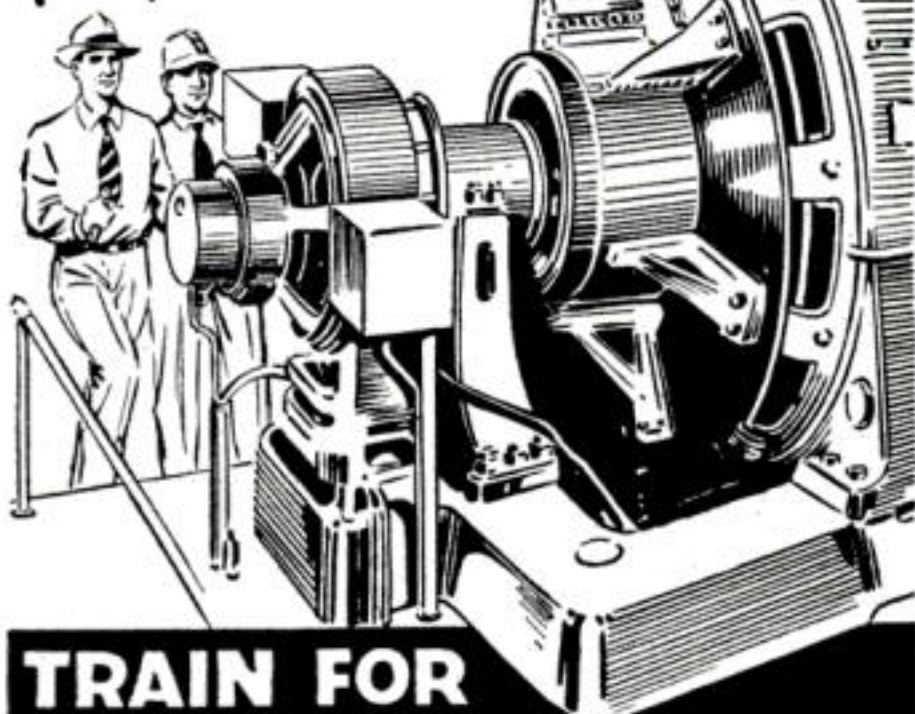
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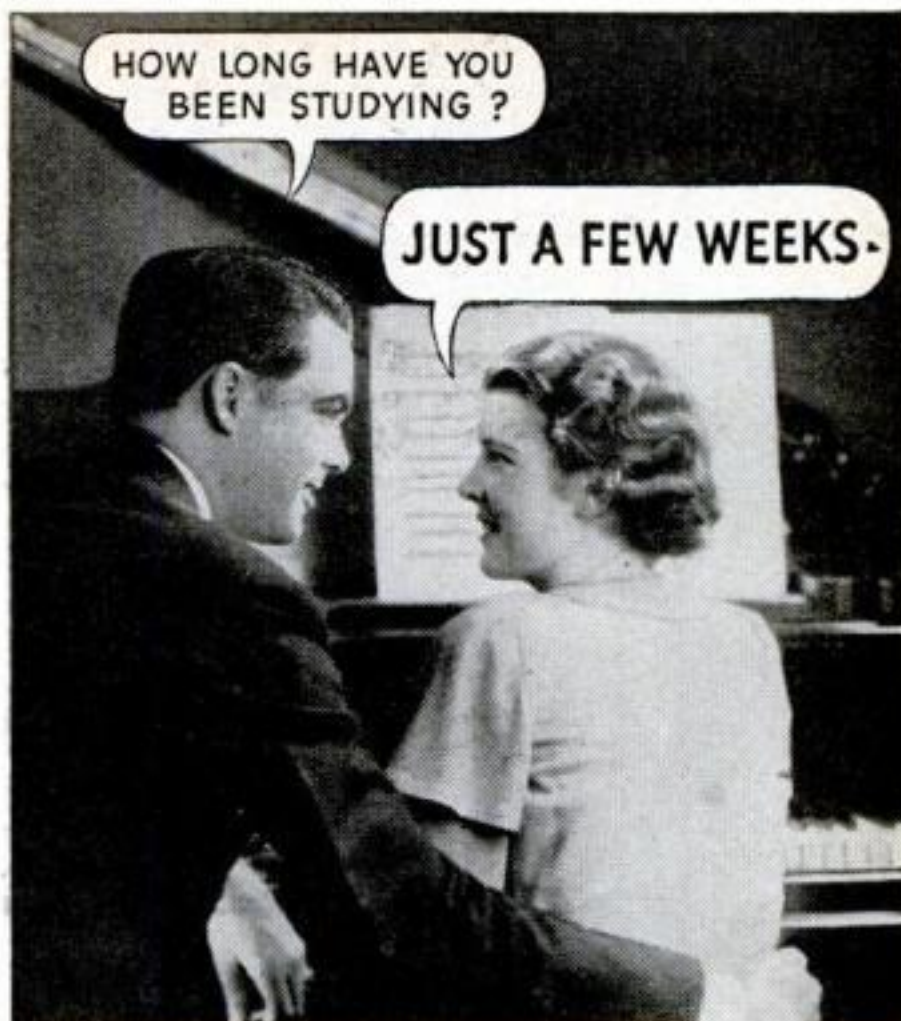


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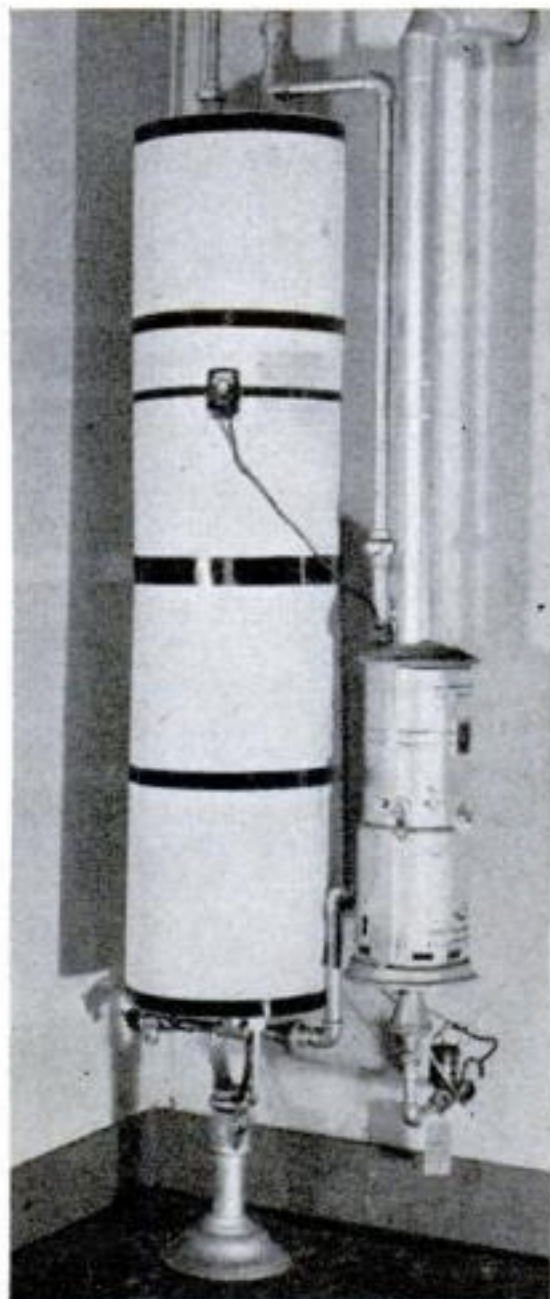
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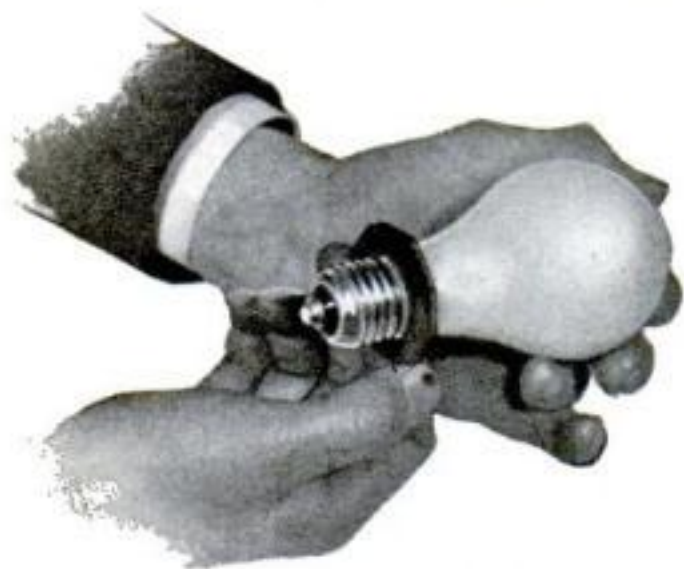
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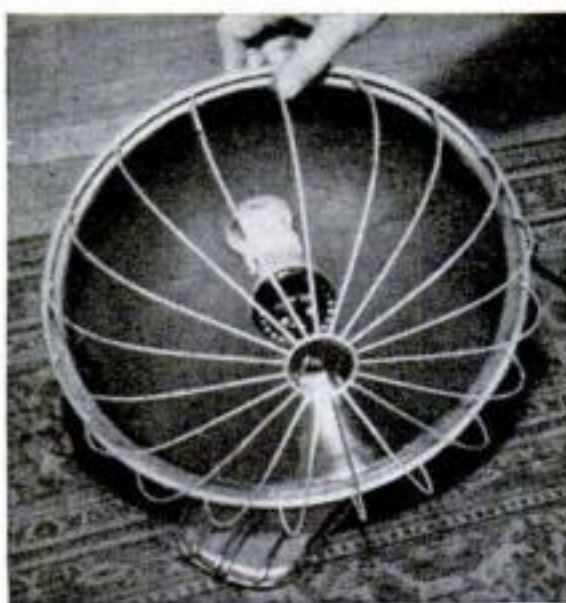


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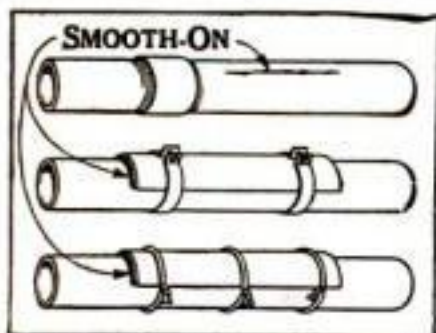
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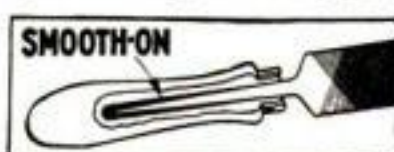
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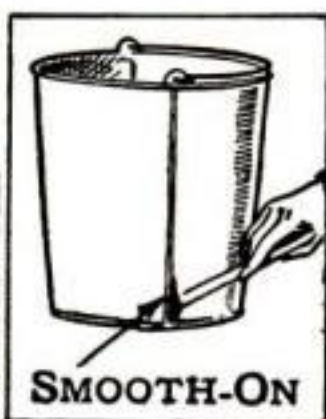
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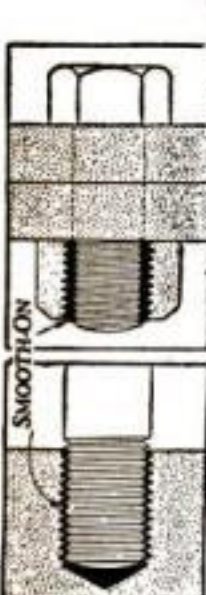
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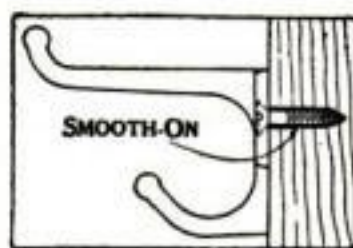
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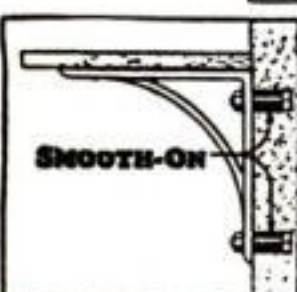
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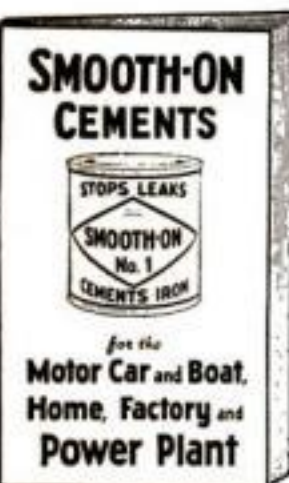
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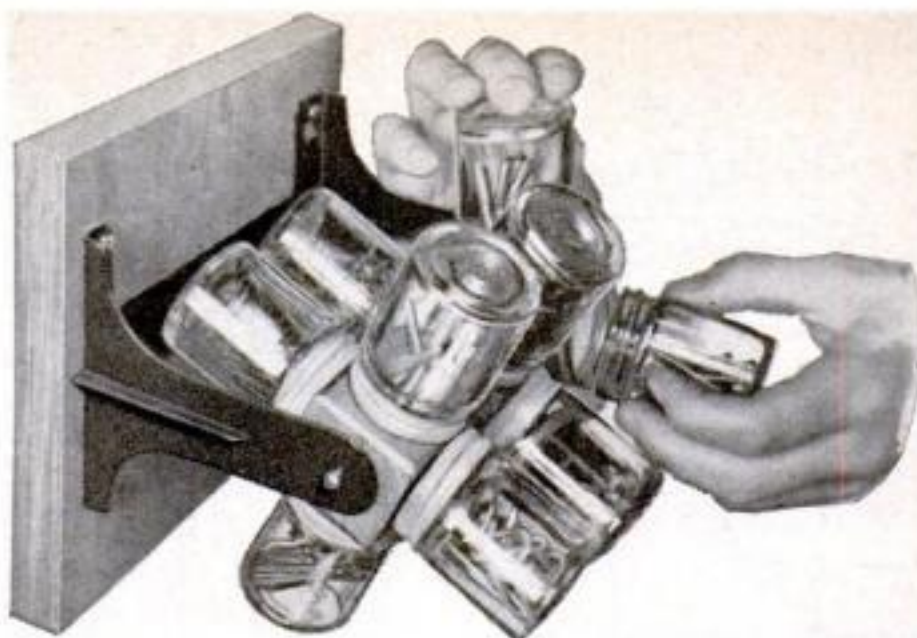
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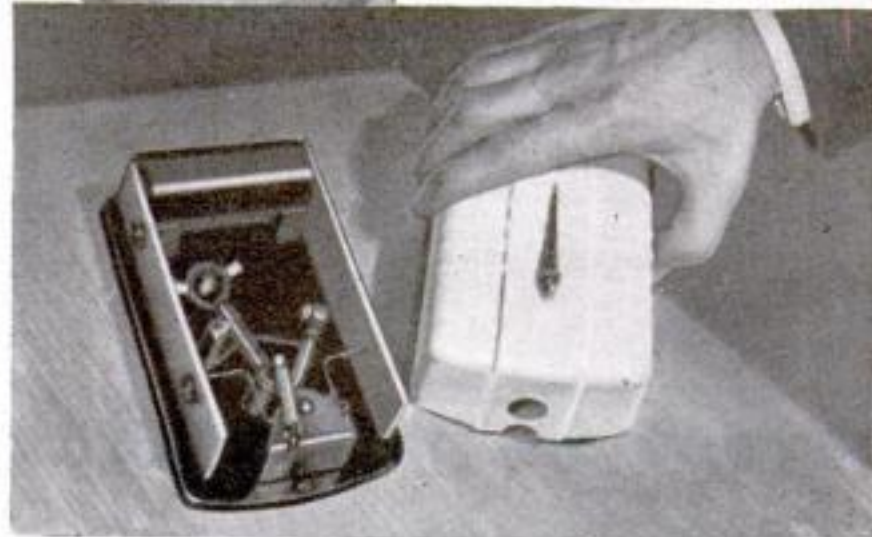


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| <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Machinist | <input type="checkbox"/> R. R. Section Foreman |
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| | | <input type="checkbox"/> Sign Lettering |
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DOMESTIC SCIENCE COURSES

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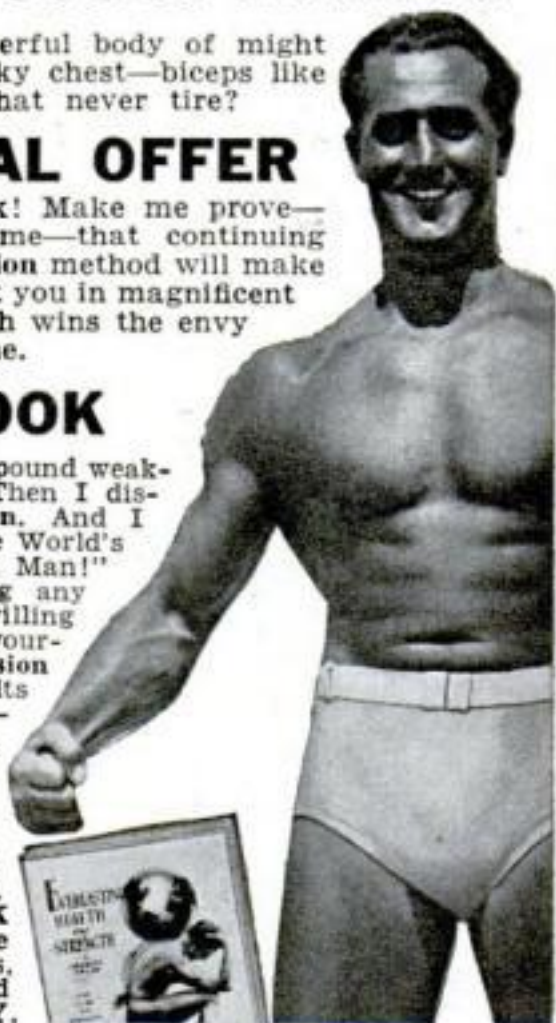
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A.—You will likely get the best results by using sodium silicate, or water glass, which is sold in what is known as a forty-percent solution. Dilute this, however, to the proportion of three parts water to one part water glass. Apply three coats to the tubs with a brush, allowing each coat to dry thoroughly. This treatment should fill the holes and make the tub hold water.

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Stains on Stone Steps

Q.—CAN you tell me how to remove bluish-purple stains from stone steps? The cause of the stains was the correcting fluid used in stencil work. I have tried to remove it with several different solutions, but without success.—Mrs. F.J.O., Irvington, N.J.

A.—STUBBORN stains on concrete and stone can often be removed by scrubbing with a hot solution of four ounces of tri-sodium phosphate in one gallon of water to which four ounces of washing soda has been added. Rinse thoroughly with clear water after scrubbing.



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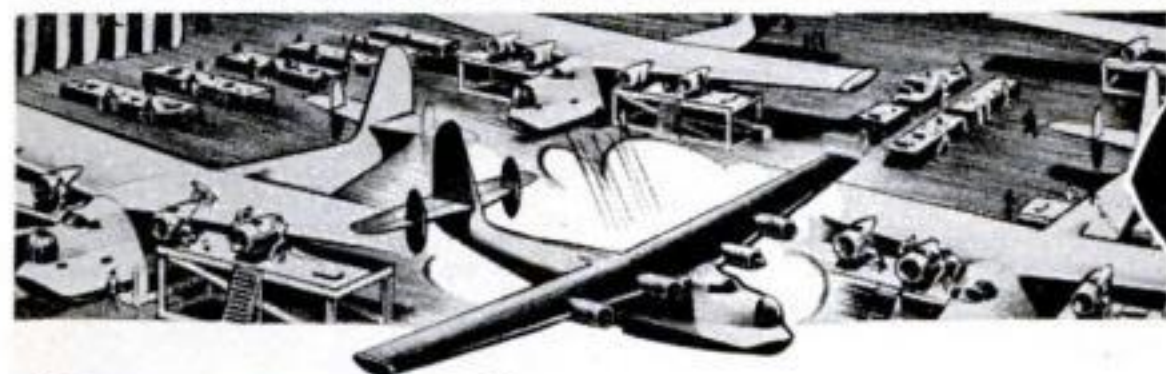
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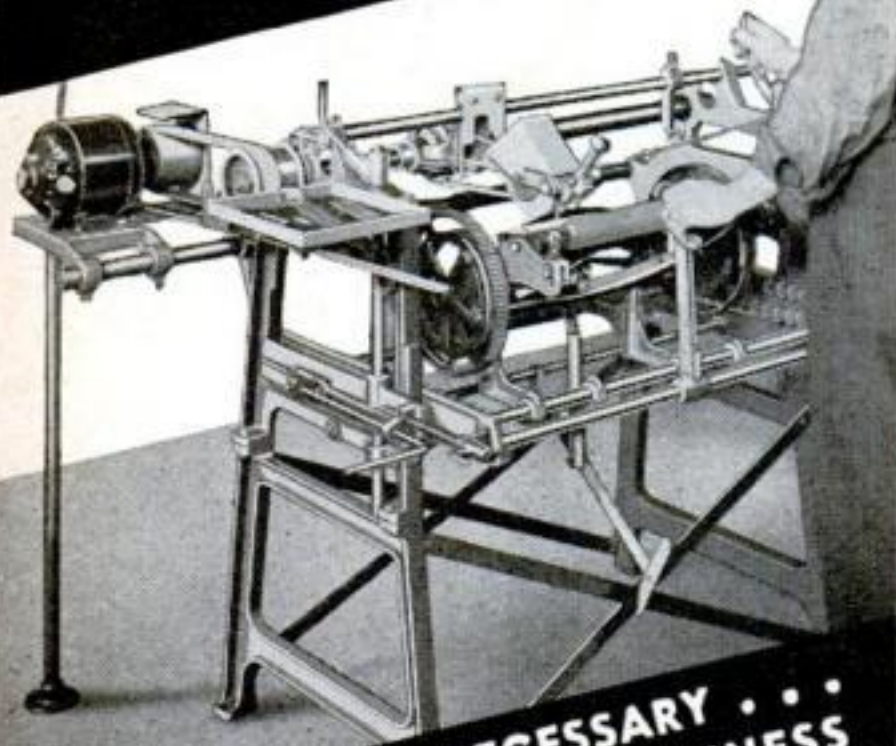
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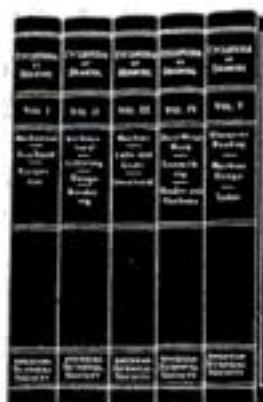
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Foundry 1-2	10-28	6-21-28	98
Forging 1-2	13-28	7-3-28	96
Practice in Tracing 1	28	2-20-28	86
Machine Drawing 1-6	31-28		94
Machine Shop Work	1-28		95
Tool Making 1-4	17-28		95
First Year Algebra	2-8-29		88
Tool Design 1	3-5-28		93
Welding 1-3	8-21-28	7-13-28	97
Plane Geometry 1	11-15-28		95
Mechanism 1	10-30-28		95
Metallurgy 1	10-30-28		100
Trigonometry	1-21-29		90
Machine Design 1-2	10-9-29		79
Gas and Oil Engines 1-3	2-8-28	4-22-29	96
Steam Engines 1-2	7-2-28	1-9-28	95
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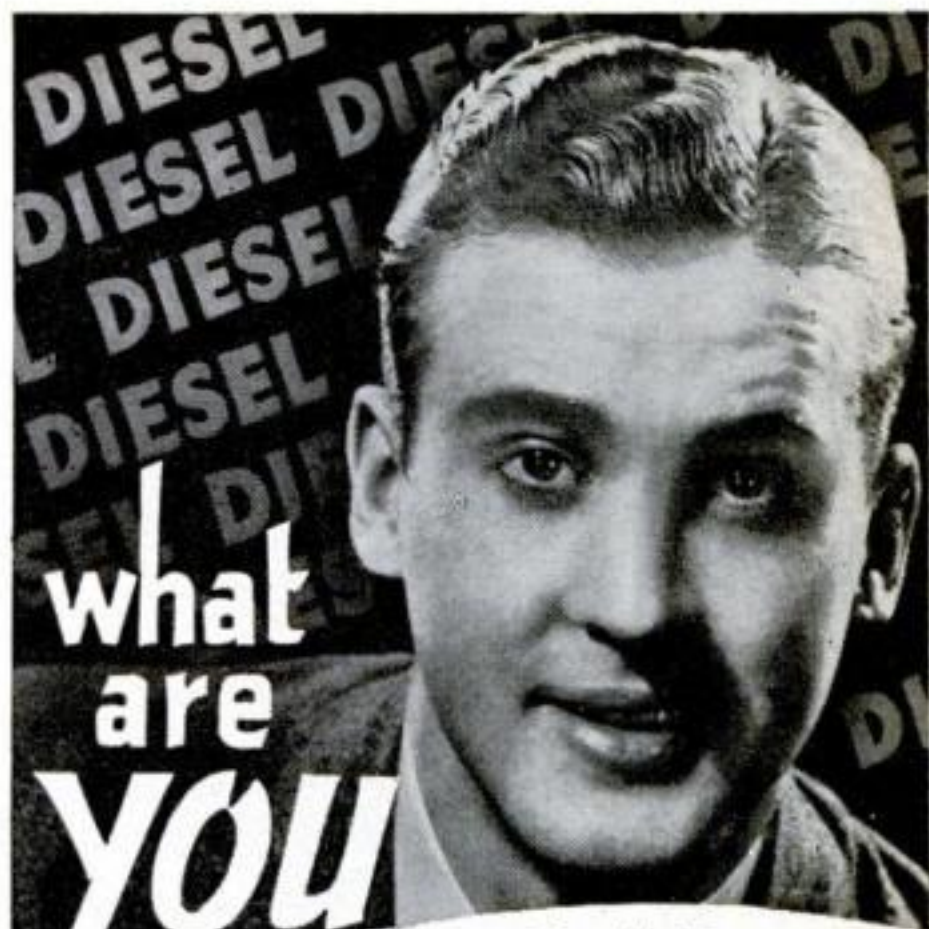
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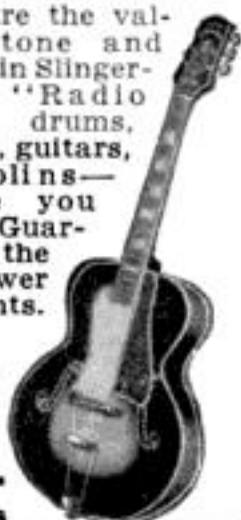
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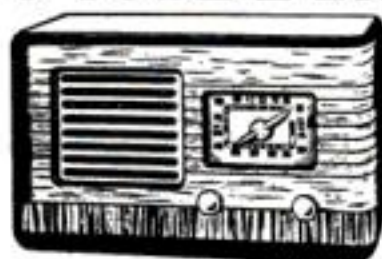
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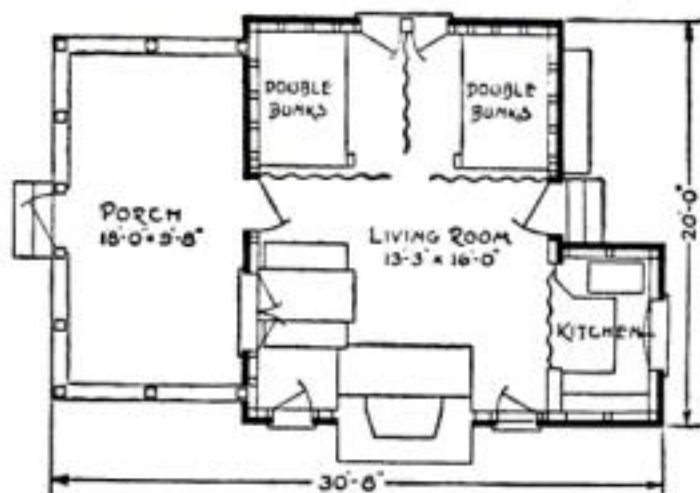


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AT Last! All your snapshots in natural colors. Roll developed. 8 natural color prints, only 25c. Reprints, 3c. Amazingly beautiful. Natural Color Photo, Janesville, Wisconsin.

ROLLS developed. Two sets prints plus enlargement coupon, 25c. Reprints, 3c. Over 19 reprints, 2½c. Jones Studios, Davenport, Iowa. "Where the West Begins."

IDEAL Photos. Deckle edges with wide borders. 25c per roll of 8 and Free enlargement. Ideal Photos, Box 2255, Paterson, N. J.

FREE Print, album, and negative file. Send your negative. Memrilane Studios, General P. O. Box 666, Dept. "S", New York.

ROLLS developed, two prints each and two free enlargement coupons, 25c; reprints, 2c each; 100 or more, 1c. Summers' Studio, Unionville, Mo.

8 ENLARGEMENTS—films developed plus 8 enlargements, 25c coin—116 or smaller. Enlarge Photo, Box 791, Dept. PSM, Boston, Mass.

20 REPRINTS 25c, 100—\$1.00. Roll developed 16 prints 25c. 5x7 enlargements 10c. 3—25c. Nordskog, 58, Maywood, Ill.

PROFESSIONAL, overnight service. Developed, printed, 2 enlargements, 25c. Fotoservice, 1942 Marlow, Toledo, Ohio.

EIGHT Silvertone gloss enlargements or eight prints and two enlargements, 25c. Mayfair, Box 261-A, Toledo, Ohio.

SENSATIONAL Offer. Five 5x7 enlargements 29c. Cardinal Photos, Summit, N. J.

PROMPT Service! Rolls developed, two Velox prints each negative, 25c. Hensch Studios, Harrisburg, Penna.

OUTSTANDING Trial offer. Roll developed and 8 prints, 15c and this advertisement. Saunders, Glenview, Ill.

ROLLS developed—16 guaranteed prints, 25c. Dick's Photo, Louisville, Ky.

ROLL developed, 16 guaranteed prints 25c. Smart Photo, Winona, Minn.

POST MARKS

ASSORTED, any quantity. United States ½c each. Foreign 1c each. Stamps accepted. Arith-Magic, Maywood, Ill.

POULTRY & SUPPLIES

MAKE Money with poultry. Read America's leading poultry magazine for latest information. Three years \$1.00; nine months 25c. Poultry Tribune, Dept. C-91, Mount Morris, Ill.

LOW Factory prices on Poultry Equipment Wire fabrics. Free 100-page catalog. Bussey Pen Products, 5151 West 65th St., Chicago.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, LABELS

HAMMERMILL letterheads, any color paper, ink; 300 8½x11, \$1.48 postpaid. 30 type styles. Free particulars. Woodruff's, 217D Lewis, Duluth, Minn.

1,000 LETTERHEADS, statements, envelopes, \$2.79. 5,000 \$9.95. 1,000 Business cards \$1.49. E. Cotter, 2457 Seyburn, Detroit, Mich.

500 LETTERHEADS 8½x11—\$1.75. 500 multigraphed letters—\$2.75 postpaid. Irving Letter Service, 4123 N. Kildare, Chicago.

125 8½x11 TWENTY pound Bond letterheads and 125 envelopes \$1.00 postpaid. Benneville, 907 West Roosevelt, Philadelphia.

BUSINESS Cards; \$1.00—1,000, postpaid. (Samples, state business.) Universal, 3316 Hiawatha, Minneapolis, Minn.

CUTS 2x3" from drawings and photos \$1.00. Joe Rek, 118 Gazette Ave., Lexington, Ky.

ASK for our 65c printing bargain. Sicoan, 2038 Obea, St. Louis.

50 SHEETS, 20 Envelopes, 25c postpaid. Western Stationery, Topeka, Kansas.

PRINTING OUTFITS & SUPPLIES

PRINT your own cards, stationery, circulars, advertising. Save money. Easy rules furnished. Print for others, big profits. Junior outfits \$8.25, senior outfits \$16.55 up. Details free. Kelsey Presses, H-8, Meriden, Conn.

HAND presses, type and complete printers supplies. Send stamp for new 52-page catalog. P. Peiffer & Company, 4 Columbia St., Newark, N. J.

NEW type 29c font. Catalog dime. Box 123F, Jackson, Mich.

6x9 PRESS \$5.00. Bargain literature free. Novelty Shop, Downsville, La.

WANTED—Printing presses, light power tools. Reid, B-172, Webster, Mass.

BARGAINS. Presses, type. List 3c. Exchange, A-27, 54 Liberty, Meriden, Conn.

PROFITABLE OCCUPATIONS

LET a Washington attorney, newspaperman and former senator's secretary give you advice which helped place hundreds in Government positions. Send fifty cents for his booklet. Address: Seeking a Government Job, 505 Insurance Bldg., Washington, D. C.

RAISE Rabbits and Cavies for us. Full details. Catalog, contract and magazine 10c. Or send 25c for book, catalog and year's subscription to Small Stock Farmer Magazine. Stahl's, Box 11, Holmes Park, Mo.

M. M. Earned \$267, three weeks, raising mushrooms in cellar! Exceptional, but your cellar, shed perhaps suitable. We buy crops. Book free. United, 3848 Lincoln Ave., Dept. 116, Chicago.

MAKE "folding" money with a folding rule. 1-E-Z-On-, 30 North LaSalle, Chicago.

STANDARD Rabbit Journal, Milton, Pa. Year 50c. Sample Dime; Supplies.

RADIOS, SUPPLIES & INSTRUCTION

RADIO engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Poplar St., Valparaiso, Ind.

RADIO kits—\$3.95 up. Single band; all wave, 5-10 tubes. Save 50%. McGee Radio, EP-10, Kansas City, Mo.

RADIOS: Save 50%. Agent proposition. Catalog free. Autocrat-B, 3855 North Hamilton, Chicago, Ill.

RARE COINS

WE pay cash for old coins. Certain 1909 cent \$10; Liberty head nickels before 1914—\$500; 1864-1865 Indian head cents \$100 each; dimes before 1895, \$600 Some worth \$6000 each. Have you valuable coins? Get posted. Send 15c for our illustrated catalog of coins we buy. National Coin Corp., (Uninc.), Daytona Beach, Fla. (3).

FREE! Foreign coin, banknote, and large illustrated coin catalogue. Send 4c postage. Coin approvals sent. Tatham Coinco, Springfield-D50, Mass.

UNITED States. Large cent, 2c bronze, 3c nickel and bargain list, 25c. Eleven dates large cents, \$1.00. George P. Coffin Co., Augusta, Maine.

BRILLIANT—1939-S or 1939-D uncirculated cent and catalogue 10c. Landon, 901-B Lucerne, Los Angeles.

FREE coin list—have large stock. Keim, P.O. Box 103, Station A, Flushing, N. Y.

ROCKS & MINERALS

MINERAL Specimens and books on mineralogy, gem polishing, fossils. Catalog .05. The Gem Shop, Box F797, Helena, Montana.

RUBBER STAMPS

DEEP letters! Two lines 25c. 3—35c. Ad-Crafts, LaCrosse, Wis.

3 LINE stamp, 25c; 3 lines cushioned 30c. Prinrite, Wauwatosa, Wis.

SCOTCH TWEEDS

SCOTCH Tweeds, \$2.00 yard. Similar tweeds retail \$10.00 yard, in United States. Dime brings samples and "Consumers' Digest" expose—"What's Wrong with Men's Clothing?" Bridge Mill, Galashiels, Scotland.

SONGWRITERS

WANTED: Original poems, lyrics, songs by a recognized music organization. Our contracts Guarantee Publication, marketing; include expert collaboration, where required. We give you advantages not obtainable elsewhere. Send your material today. Music Publishers Agency, Dept. X16A, Portland, Ore.

WANTED. Poems, to be set to music. Submit for consideration. Transcription records made. Keenan's Studio, PS, Box 2140, Bridgeport, Conn.

SONG poems wanted to be set to music. Free examination. Send poems to McNeil, Master of Music, 510-PS-So. Alexandria, Los Angeles, Calif.

SONGWRITERS—Write today for free booklet "Building an Income Thru Songwriting." Songwriters Institute, 1234-J Broadway, New York.

RECORDING Songs, poems; Dollar per minute. Ray Turner, Hotel Tilden Hall, Champaign, Ill.

FREE, inspiring booklet describing songwriting opportunities. Allied Music, Dept. 5, Box 507, Cincinnati, Ohio.

SONGWRITERS: Send your poem today for immediate consideration. Richard Brothers, 146 Woods Bldg., Chicago.

SONGWRITERS Wanted. Work guaranteed. Publication. Great Eastern, 40PS2, Thomaston, Maine.

SONGWRITERS! Poems, music. Amazing offer. Hibbeler, C-15, 2157 N. Avers, Chicago.

SONGWRITERS—Send poems; free plans, reports. Variety, Dept. G, Salem, Ind.

SPORTING GOODS, GUNS, FISHING TACKLE, ARCHERY

GUNSMITHING readily learnt at home. Repair personal and neighborhood's firearms. Free catalog 20 firearm and gunsmithing books. Tom Samworth, Marines, N. C.

ARCHERY: Ideal sport and recreation. Complete instruction book, 50c. Catalog free. Chester Brown, 617 South State, Chicago.

HUNTING, fishing, trapping, outdoor equipment, used guns. List and catalog free. Howe Fur Company, Coopers Mills, Maine.

ARCHERY Supplies. Catalogue free. Instruction book 50c. Midwest Archery, 2209-D East 75th, Chicago.

"TRAINING Bags" for punch and speed, at cost price. Circulars 10c. Andre's Gym, 3520 Mt. Elliott, Detroit, Mich.

BOW and arrow supplies. Catalog 15c. Roy Hancock, 323 Douglas Ave., Portsmouth, Va.

STAMP COLLECTING

RIOT of colors packet includes 2 large multi-colored Ecuador Constitutions, 3 Philippines (Rizal), 3 beautiful triangles, plus stamps from Andorra, Monaco, Senegal, Ivory Coast, Futuna, Angola, Estonia, Oceanica, Tunisia, Ukraine, Cape Verde, Kouang Tchou, New Caledonia, Victoria. This bizarre assortment of over 20 different stamps containing pictorials and commemoratives will be given as a premium to the first 500 collectors who send only 5c for our big value 100 different packet. McLoughlin, North Ave., Meriden, Conn.

STAMP Outfit free! Scarce airmail triangle from the Mozambique Co.; genuine North Borneo (Buffalo Transport); fine packet Jungles and Countries only (a real thriller) including Sarawak (White Rajah), Belgian Congo, Perak, Sudan (Desert Scene), etc., also set U. S. stamps (50 years old!) and extra Surprise Gift—this big outfit absolutely free with dandy approvals and lists! Send 3c for postage. Midwood Stamp Company, Dept. 5R, Midwood Sta., Brooklyn, N. Y.

FREE! World's smallest triangle, Bolivia triangle, Gigantic diamond-shaped airmail. Packet old United States. War packet—Finland, Russia, Danzig, Poland, Czechoslovakia, Asiatics. Set twentieth-century Philippines, Devil's Island, Congo, Canibaland, Tunisia, Soudan, West Indies, Southseas, Africa, Br. Cols., pictorials, commemoratives, perforation gauge, millimeter scale. Postage 3c. Approvals. Davidson, 2297-S 6E., Salt Lake City, Utah.

FREE! The Stamp Finder! Send today for big new edition, fully illustrated, enabling you instantly to identify all difficult stamps! Also fine packet strange, fascinating stamps from Bosnia-Herzegovina, Monaco, Patiala, Cyprus, etc., including maps, ships, animals and strange scenes. All free to approval applicants enclosing 3c postage. Garcelon Stamp Co., Box 918, Calais, Maine.

BIG Packet Free! Unusual stamps including scarce Zeppelin; smallest triangle; Indochina airmail; old Eastern Roumelia; Canadian Coronation, Silver Jubilee; Italian East Africa; giant diamond-shaped stamp; Mozambique; Liberia, Holy Lands stamps from Palestine, Lebanon, Iraq, etc., many others. Only 5c to approval applicants. Frederick Pitts Company, Framingham, Mass.

YOUR ad in these columns will stick out, get more attention. If you use white space as shown here. Yet the cost is little more. For details, address Classified Ad. Mgr., 11th Floor, 353 Fourth Ave., New York, N. Y.

NEJD (Saudi Arabia)—Bolivia Eucharistic Triangle, Cayman Island Pictorial, Negri Sembilan, Turks & Caicos Islands, Manchukuo, Bahamas War Provisional, Five Dollar United States, British Solomon Islands (Cannibaland). Everything 3c with our famous approvals. Viking Stamp Co., 1-P Hanson Place, Brooklyn, N. Y.

SIX dollars for 9c! 300 different stamps (Cat. price \$6.00) only 9c with approvals. Tatham Stamp Co., Springfield-50, Mass.

WORLD'S Smallest airmail - largest map diamond and triangle stamps, free stamp magazine, magnifier to study stamps, with large packet of stamps from many countries. A bargain 5c with approvals. Capital Stamps, Dept. 10, Little Rock, Ark.

GIFT Edition stamp annual free. Sixty pages with hundreds of illustrations featuring Canadians, Newfoundland, United States, Colonials, foreign, supplies. Sent free. Gray Stamp Co., Dept. PR, Toronto, Canada.

ALL-AMERICAN Bargain approvals: Applicants given 100 different South-Central American collection for 10c. Without approvals 25c. Davis, (APS), Silver Lake, Ind.

SOMETHING Unusual! Hong Kong Coronation first day cover plus 10 different Philippines including commemoratives 3c with approvals. Stanley Melzer, 3120 South Adams Ave., Milwaukee, Wis.

ELUSIVE Imperforate triangular miniature sheet with 100 different stamps—10c. Friendly Filatelists, Box 4428P, Philadelphia, Penna.

150 DIFFERENT U. S.—50c! Unpicked mixture: 40c pound, 100 U. S. revenues on documents—10c! (700—50c). Vanvoorheis, Hyndman, Penn.

500 FOREIGN mixed stamps; absolutely unpicked; many interesting. Only 10c with approvals! Saxon Company, 408-B Jay St., Brooklyn, N. Y.

FINE Approvals. Freshly filled books and sheets. Tell me what you want and I will send it. Milton Skinner, 306 East Fourth, Long Beach, Calif.

COLLECTORS, Superb set Army or Navy issues, 6c to applicants for our fine U. S. approvals. Harvard Stamp Co., 318 Harvard St., Brookline, Mass.

NUDE Duchess, Hindenburg, Zeppelin. Transatlantic airmail commemorative, all 5c with approvals. Laurence Shultes, Berne, N. Y.

PAGODALAND Packet, strange countries weird people. 3c with approvals. Kravat, 1925-S Quentin Road, Brooklyn, N. Y.

50 DIFFERENT, fine U. S. including perforation Gauge, 10c with approvals. The Stamp Shop, 813 Holland Building, St. Louis, Mo.

FREE! Select 10 stamps from our approvals free. Just send names, addresses 2 active collector friends. Ranger Stamp Co., Dallas, Texas.

50 FREE, Iraq, Iran, etc., Catalogued \$1.00. Album 3c. Bullard, 268D Northampton, Boston, Mass.

FREE—3 beautiful sets of stamps; Approvals. Price list on request. A. J. Ceula, 1084 Broad St., Newark, N. J.

PHILATELY! Cachets! Posters from Hawaii! "Chinese Hobby Journal" 50c year. Box 1813, Honolulu, Hawaii.

IRAN Royal Wedding, three values, unused—4c. Approvals. Claire's, 7402 Bayparkway, Brooklyn, N. Y.

AIRMAILS! Diamond-shaped beauties, complete set, 3c with approvals. Gordon, Box 201, Clifton, N. J.

300 DIFFERENT Foreign, commemoratives, pictorials, etc. 25c. Kurtz, 523 Elliger, Allentown, Penna.

1000 MIXED U. S., including commemoratives, precancels, 15c. Lee, Bridgeport, N. Y.

140 FINLAND—Morocco—Uruguay—Antioquia—Johore—Mozambique, etc. 10c. Lufbery, Middletown, Conn.

5 SETS, premiums, packet 3c with approvals. Mailmart, Box 27, Grand Central, New York, N. Y.

FREE Slovakia set to serious approval applicants. Stamps, 8018 Cooper, Lexington, Ky.

5 TRIANGLES, 100 World, 10c. Approvals. Ransom, 1333 Pontiac, Ann Arbor, Mich.

PENNY approvals. Thousands different. Pictorials, commemoratives. Raymax, Station Y (21-X), Brooklyn, N. Y.

EXCHANGE your duplicate stamps. List. Swappers, dime. Registrar, Box 2166, Denver, Colo.

FREE! Royal visit packet. Postage 3c. Roberts, 312U Shearerbldg., Baycity, Mich.

UNITED States stamps on approval. Big discounts. Free premiums. Stamp Company, 452 Broadway, Albany, New York.

FREE! Illustrated price list with perforation gauge. Shoenbach's, 202 W. 96th, New York.

FREE! Twelve desirable airmails. Approvals. S. Barker, 714 Market, San Francisco.

1940 WHOLESALE Catalogue free—eighty pages. Empire Stamp, Dept. 19, Toronto, Canada.

44 DIFFERENT U. S. Commemoratives 25c. Blackstone, Walnut Ave., Wayne, Penn.

PERU. Special introductory offer. 108 different \$1.00. Mutze, Lima-Peru, AP-1553.

PENNY Approvals that satisfy. Neil Gronberg, Box 54418, Philadelphia, Penn.

72 DIFFERENT U. S., 10c. Album Service, Route 57-10, Sioux City, Iowa.

PENNY Approvals that please. Haywood, 395 Adams St., Pomona, Calif.

FREE Treasure Packet. 3c please. Oromocto Stamps, Kitchener, Ont., Canada.

300 DIFFERENT 20c; 1000 75c; 2000 \$2.50. Fred Onken, 630 79th St., Brooklyn.

FREE! Austria war set. Postage 3c. Williams, 601 Archerbldg., Baycity, Mich.

150 GOOD mixed foreign stamps 5c, coin Stanton, Niantic, Conn.

1000 EXCELLENT U. S. 25c. 1000 Foreign 20c. Steiber, 306-139th, Bronx, N. Y.

U. S. Approvals. Seminole Stamp Studio, Box 416, Miami Beach, Fla.

THREE sets for three cent stamp! Jack Reed, Houtzdale, Penna.

25 JAPAN 3c, with approvals 1/4c up. Josip Babcock, St. Joseph, Mich.

TATTOOING SUPPLIES

TATTOOING. Engraving. Outfits. Illustrated list free. Percy Waters, Anniston, Ala.

TAXIDERM

GLASS eyes, Taxidermists', Furriers' supplies. Big catalog Free. Elwood Company, 228 Smith Bldg., Omaha, Nebr.

STEERHORNS and goat horns. Polished and in the raw. Blowing horns. R. G. Johanson, 810 Olive St., Houston, Texas.

FOX Skins made into beautiful furs, special, \$8.00. Patton's Taxidermy, Paradise, Pa.

TOBACCO

CHEWING. Four pounds \$1.30. Smoking Gold Leaf Burley, Turkish three pounds \$1.15, postpaid. Belmont Farms, Chatham, Va.

TYPEWRITERS, OFFICE DEVICES

TYPEWRITERS, adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

WANTED—MISCELLANEOUS

CASH for used scientific instruments, tools, microscopes, cameras, binoculars, etc. Write details. Elman's, 2300PS Van Buren, Chicago.

WILL buy your unused United States stamps. Small discount. What have you? Mint Sheet Brokerage Co., 423 Caxton Bldg., Cleveland, Ohio.

WATCHES

WATCH-REPAIRING is steady profitable work. Experts usually in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Company, C-2005 Manhattan Building, Chicago.

WATCHMAKERS' Materials, tools: watches; jewelry. Bought, sold, exchanged. Ben Segal's, Mailers Building, Chicago.

WELDING, SOLDERING

D.C. ARC-WELDER plans \$1.00 each (three for \$2.00). Build it yourself without rewinding armature. 25-200 amperes from farm light plant generators. 25-200 amperes from Northeast Dodge automobile generators. 25-600 amperes from d.c. vehicle motors originally storage battery driven. Welders Club, WB-3432 M-Mart, Chicago. For Sale: D.C. vehicle motors, supplies, etc.

75-200 AMPERE Welders from old generators. Complete plans 35c. Plans show single and dual welder connections. LeJay Manufacturing, 323 LeJay Bldg., Minneapolis, Minn.

BUILD powerful 110-220V A.C. Welder for \$5.00 without winding. Pole transformer and \$10.00 makes 200A Welder. Both plans \$1.00. Information dime. Hi-Point Electric Products, Bellefontaine, Ohio.

REBUILT Welders. All sizes. Engine or electric drive. No junk. Fully guaranteed. Low prices. Tern's Service Co., 3732 Cedar Ave., Cleveland, Ohio.

ELECTROPLATE small parts. Low-priced outfit for laboratory or amateur. Choate Mfg. Co., 3464-G Principio Ave., Cincinnati, Ohio.

WELDING - Cutting outfits, \$27.10 and \$36.56. Superior Oxy-Acetylene, Hamilton, Ohio.

ACETYLENE Welding generators, latest type. \$25.00. Johnson Generator Co., Brookfield, Mo.

110-220 VOLT arc welders, helmets, plans, material. Holgerson, Canton, Kansas.

VEHICLE generator, 300 amp. Welder \$30.00, 1323 Virginia St., Elizabeth, N. J.

WIND ELECTRIC PLANTS

WHITE Space, as used here, makes your ad stick out, and costs little more. It will pay you to investigate this. Simply drop a postal to Classified Ad. Mgr., 11th Floor, 353 Fourth Ave., New York, N. Y.

FREE Electricity from Wind. Build your own Windcharger. Cost 98c for material plus used car generator. Drawings—Instructions 10c. Wesco, Minneapolis, Minn.

HER DROWNING CRIES SPLIT THE ICY NIGHT!

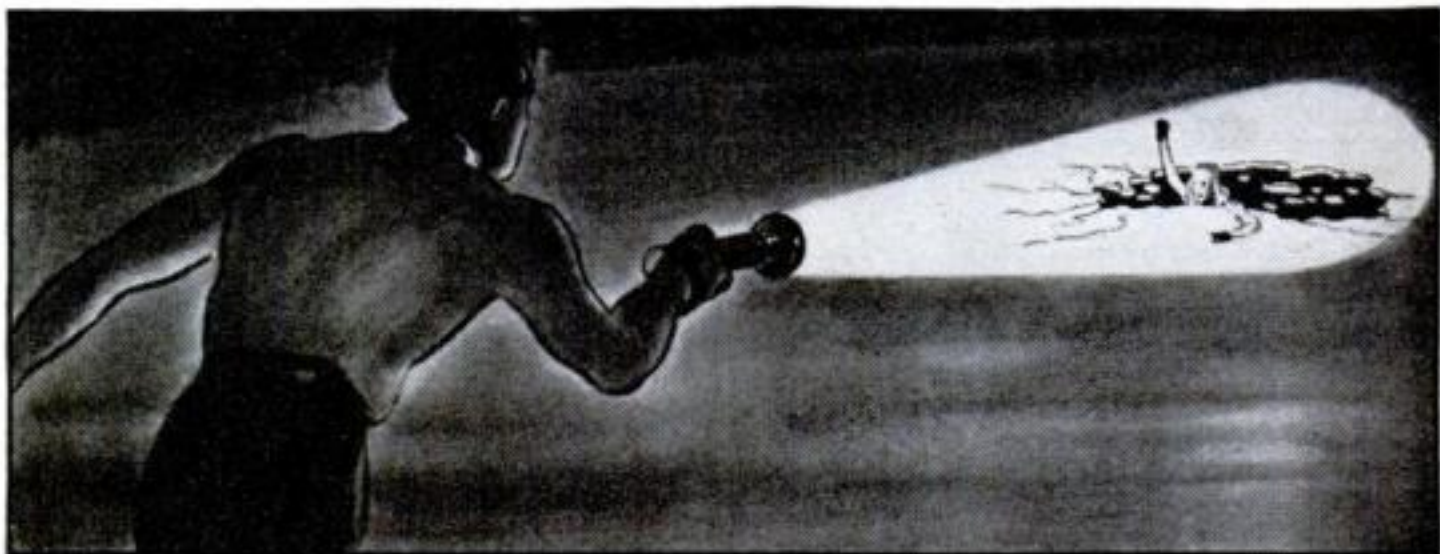


A true experience of GEORGE W. TICE, JR., Lebanon, Pa.



1. "ONE BITTERLY COLD NIGHT I decided to go skating at a dam where usually the ice was safe. I was starting to put on my skates when screams of terror sent chills down my spine.

2. "I DROPPED MY SKATES, picked up my flashlight and ran in the direction of the agonizing cries. It was pitch black, but in the bright beam of the light I saw a girl fighting a losing battle in the icy water.



3. "WITH THE AID OF my flashlight, I managed to reach the half drowned girl and pull her to safety. Without that flashlight, and its dependable 'Eveready' fresh DATED batteries, this story might have had a tragic ending.

The word "Eveready" is a registered trade-mark of National Carbon Co., Inc.

(Signed) *George W. Tice Jr.*



FRESH BATTERIES LAST LONGER... Look for the **DATE-LINE**

NATIONAL CARBON COMPANY, INC., 30 EAST 42nd STREET, NEW YORK, N. Y.

Unit of Union Carbide  and Carbon Corporation

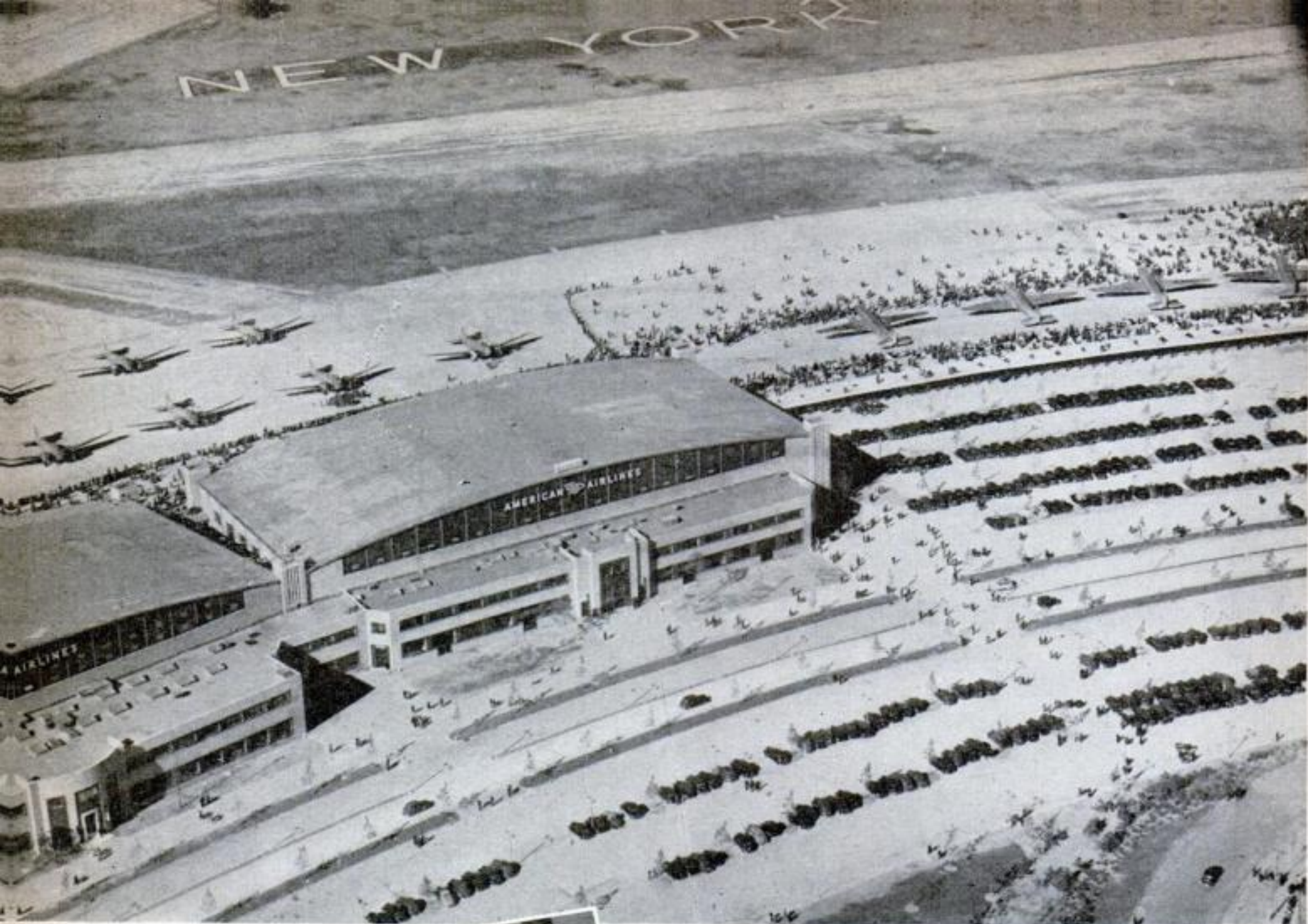


By
**SCHUYLER
VAN DUYNE**

•

**BEHIND THE SCENES
OF NEW YORK'S HUGE
STREAMLINE AIRPORT
WHERE SKYWAYS MEET**

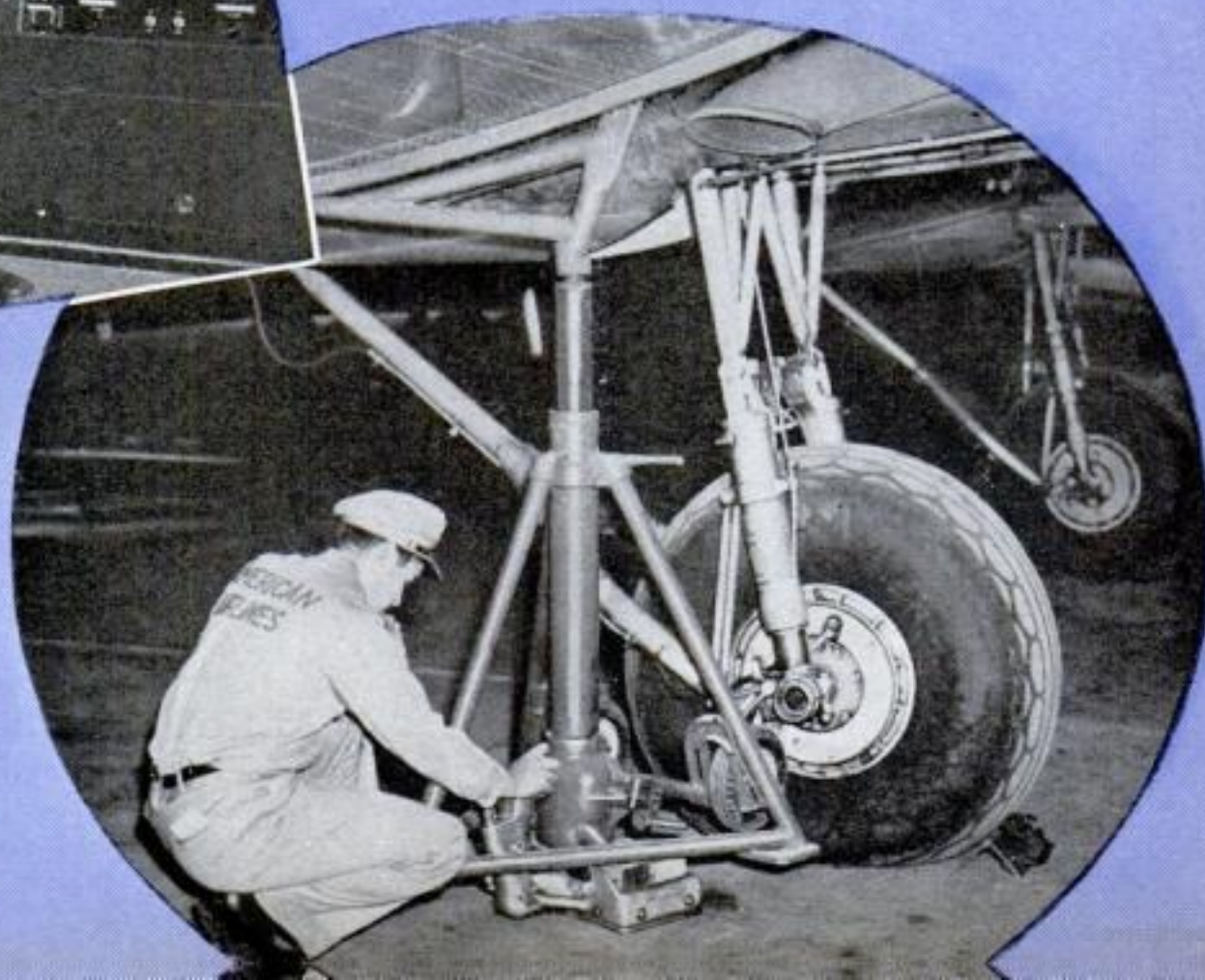
WINGING its way through storm clouds that blew in from the sea one night not long ago, a great silver transport plane filled with passengers streaked over tall skyscrapers, nosed into a tracklike radio beam, and a few seconds later glided to a landing on La Guardia Field, New York City's new airport, while



Panel of loudspeakers in the control tower at La Guardia Field. Above is an air view of New York City's new airport, showing part of the parking space and six-block loading apron for airplanes

about 300,000 spectators roared a welcome to this first scheduled commercial plane to sit down on the field. For four years, workers had labored frantically to bring the gigantic air base to completion. And now it was done.

But it was far from just another airplane landing field that came into being that night. Covering more ground than most fair-size towns, and boasting every mechanical aid that science has devised for speeding planes,



Weighing a transport plane with the aid of a portable scales, which is placed under each of the wings in turn

passengers, and mail safely on their way, it is the last word in modern, streamline sky terminals. To its seaplane basin will come the huge flying boats of the transatlantic and Bermuda services, and to its smooth broad landing field will glide the sleek passenger planes of Uncle Sam's major air lines. Already, more than 140 scheduled flights begin or end there daily, and in time, as schedules are increased, it will become the busiest airport in the world.

To create this ultramodern air base, a pile of earth four times as big as Boulder Dam was dumped into what was formerly a fifteen-foot-deep bay. Across its level surface, four asphalt-macadam runways, one of them stretching for more than a mile to make it the nation's longest, were laid down. Six hangars, bigger than football fields, with electrically operated

doors weighing twenty-five tons apiece, were erected along with eighteen other steel-and-concrete buildings.

Nerve center of the giant sky terminal is the glass-walled control tower on the roof of the three-story administration building,

Traffic-light panel in the control tower. Pneumatic treadles sunk in runways, as below, make lights flash in the tower when planes pass points not within sight



Outgoing planes lined up on the loading apron at night. Thirty powerful floodlights illuminate the scene





In the control tower, microphone cables reel off spring-operated drums attached to the ceiling

Shutters resembling awnings shield operators' eyes from blinding sunlight. Below is one of the luggage elevators on which passengers' luggage is sent for loading



where trained operators control the air traffic to and from the field. Here, compactly arranged on panels and consoles, are wind gauges, clocks, barometers, and the speakers for sixteen remotely controlled radio receivers. Banks of switches make it possible to operate the airport floodlights, traffic lights, and boundary lights, and microphone cables reel out from overhead spring-operated drums so that they never go slack as the operators move about. Outside and above the glare-free windows, easily controlled awninglike shutters screen out the blinding sunlight as well as artificial light, while projecting down from the ceiling, a convenient handle aims a powerful roof-top searchlight in any direction.

But dwarfing this searchlight and all other lights on the field is the main airport

beacon. Revolving on a pedestal on the top of the tower, it sends out a beam of light stronger and more penetrating than the light of any beacon of its type in the land. Rated at 13,500,000 candlepower, it has been sighted by pilots flying more than 100 miles away, over the Pennsylvania hills.

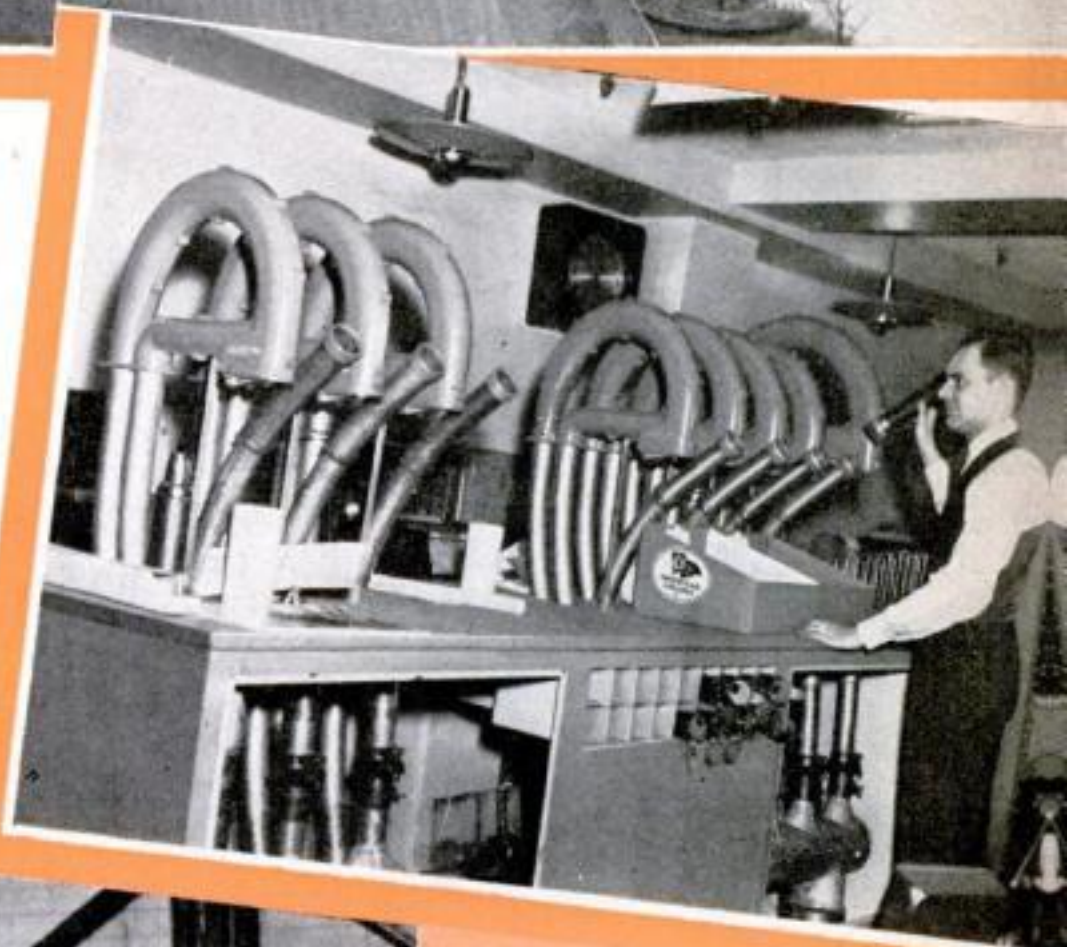
Yet the casual passenger passing through sees only the outward effects of these ultra-modern instruments and airport controls. From the time he enters the circular rotunda of the administration building where he buys his ticket, until he boards a plane, he might imagine himself in the union railroad terminal of any large city. Let's follow him through.

He leaves his car or taxi at the motor ramp leading to the main floor. Entering, he finds himself in a huge circular room with a wide central stair well leading to the ground floor beneath a domed ceiling. Around the curve of the wall, a long desk broken only by gateways serves as a ticket counter. Behind it, passenger agents of the major air lines wait to serve him.

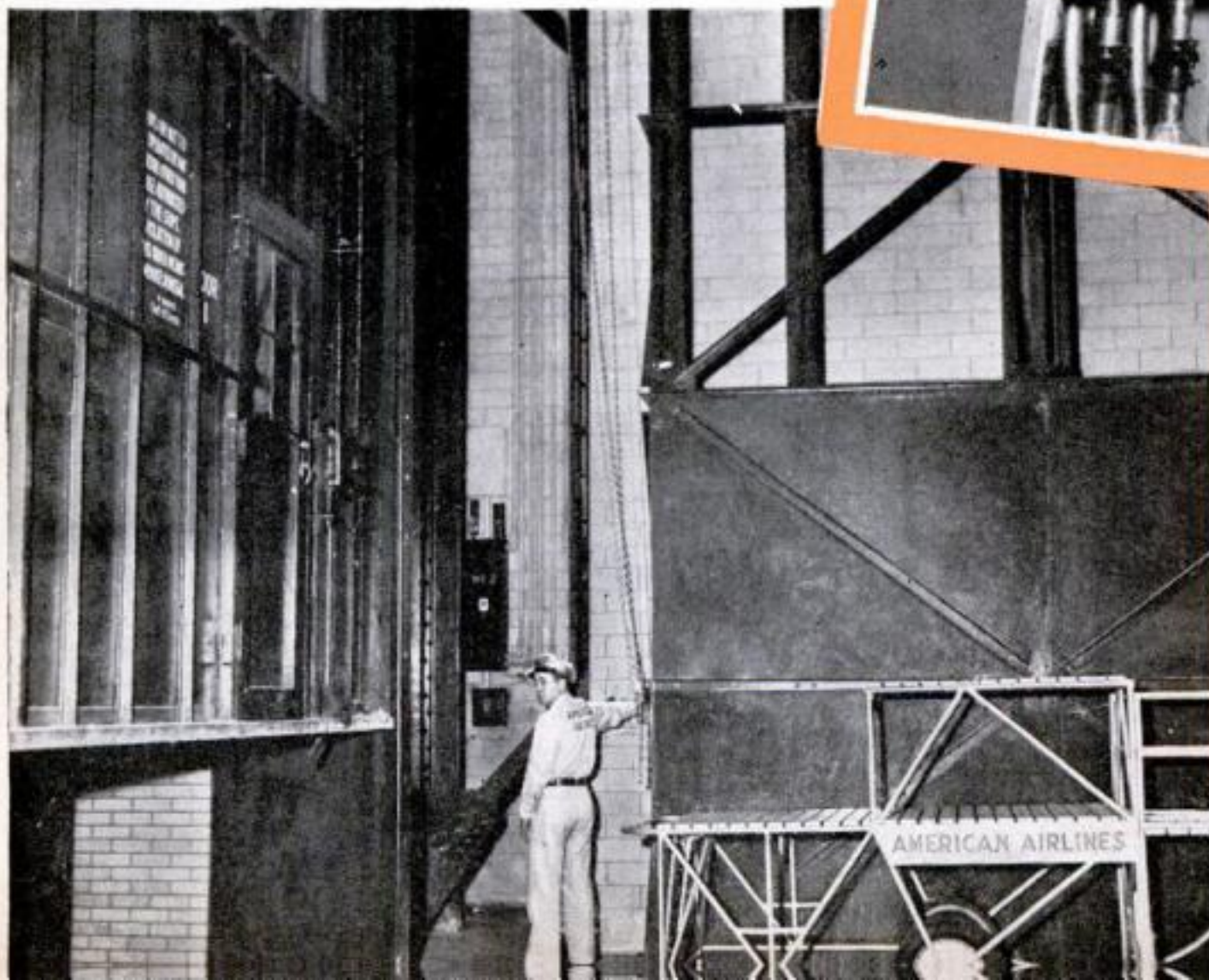


As he approaches the desk, he is asked to place his luggage on a low, built-in scale. He requests a ticket, let's say, to Montreal. From a handy desk cabinet, the agent flips out rubber stamps and a validator to mark his ticket without delay.

His luggage weighed, it is immediately placed on an electric elevator set in the wall behind the desk, and dispatched to the ground where a truck takes it to his plane. He won't see it again until he reaches his



At top, the elevated promenade for visitors. Above is a part of a pneumatic-tube system for tickets



Throwing the switch that operates one of the huge twenty-five-ton, electrically operated hangar doors

destination. Incidentally, if he were departing for Europe from the seaplane terminal at the field, he and his baggage would have been weighed without his knowing it. There, a weighing platform is cleverly concealed in the floor in front of the ticket desk, while behind the desk the dial of the scales is visible only to the agent. Passengers touchy about their weight are thus spared any embarrassment.

With a half hour to kill before plane time, our passenger wanders about the building. Newsstands, souvenir and flower shops, and a well-appointed restaurant and bar supply a traveler's needs. If he is curious, on the third floor of the building he will find the offices of the Civil Aeronautics Authority, the Airways Traffic Control, the U. S. Weather Bureau, and other organizations that serve and regulate the air-line operations.

THE minutes pass quickly until, glancing at a clock beneath a bulletin board of arrival and departure times, he finds he must hurry to his plane. At the same moment, he hears a public-address system announcing: "Canadian Colonial Airlines Flight 5, leaving for Montreal from Gate 14 in five minutes. All passengers please go to Gate 14."

At Gate 14, an agent checks his ticket as last-minute express and mail are loaded from trucks. The mail has just cleared through the airport post office, the largest of its kind in the country. He boards his plane for the take-off.

As he does, an air-line bus rolls to a stop

near the gate. Passengers who have made reservations at the air-line terminal in the heart of the city, only twenty-five minutes away, pile out of the bus and check in with the agent. Several have not yet had time to purchase tickets. The gate agent accepts their money, fills out a ticket order, and places both in a compact cylinder. This he inserts in a two-way pneumatic-tube system that connects each of the fourteen gate booths with their individual air-line ticket desks in the administration building. The cylinder speeds to its proper agent who makes change, issues tickets and speeds them back through the tube to the gate, all in less than two minutes' time. In a moment, the passengers are aboard and the pilot receives his all-clear signal.

Let's look at the field from which the ship presently will roar away. Flanking the administration building on both sides is a crescent-shape, covered walkway with passenger gates leading to the loading apron. This apron, six city blocks long, is illuminated at night by thirty floodlights. At either end of the walkway are three giant hangars.

In the distance, planes taxi and jockey on the four runways. The prevailing winds gave engineers the line for placing the 6,000-foot, northwest-southeast runway, while the three others allow take-offs and landings into winds from all other points of the compass. Boundary lights set flush with the ground 200 feet apart outline them all at night. Two narrow-beam floodlights, together equal to the brilliance of the traffic tower's beacon, are set at both *(Continued on page 239)*



Planes parked inside one of the six huge hangars, each of which is large enough to hold a football field

Be Your Own WEATHER MAN



Cirrus



Stratus



Nimbus

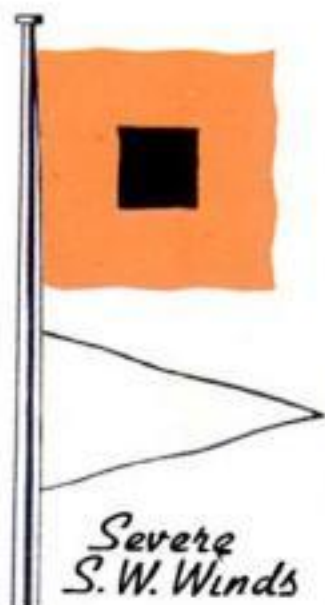


Cumulus

READING WEATHER IN CLOUDS

As a storm center approaches and passes over, certain cloud formations normally appear in a regular order. These pictures show four stages in a typical rainstorm

THESE SIMPLE RULES WILL ENABLE YOU TO FORECAST THE WEATHER ACCURATELY



RAINBOW at night is the shepherd's delight. . . . Red sky at morning is a sailor's sure warning. . . . The higher the clouds, the finer the weather. . . .

For centuries, sayings such as these have been part of the folklore of the sky. Modern science has proved the truth of many of these beliefs concerning clouds and winds as weather prophets. By understanding a few simple facts about the whys and wherefores of changes that take place over your head, you can foresee, with reasonable accuracy, the coming of storms and rapid shifts in temperature. You don't have to know anything about aneroid barometers or wind gauges. It doesn't make any difference if you can't tell an isobar from an iceberg. With two eyes as your only equipment, you can read the weather from the sky.

Take the clouds, for instance. Divided into four general types—nimbus, cirrus, stratus, and cumulus—they form one of the most important sources of clues to weather. Nimbus clouds are the thick banks, sometimes with ragged edges, from which rain or snow is falling. Cirrus clouds, consisting of ice crystals, are the thin, feathery wisps that glide across the sky at high altitudes. Stratus

clouds, as the name implies, collect in layers and often thicken into an unbroken, leaden mass without form or structure, while the fluffy, cottonlike billows that appear during clear weather are the familiar cumulus variety.

Other important clouds are either variations or combinations of these four basic types. Cirro-cumulus, for example, the sailor's "mackerel sky," a good-weather cloud, is a combination of cirrus and cumulus. Cumulo-nimbus, combining cumulus and nimbus, is the awesome "thunderhead" that occurs in spring and summer. Rising like huge mounds of white smoke from the dark base of a gigantic fire, they tower up to tremendous heights and often hold millions of gallons of rain. When the prefix "alto" or "fracto" is included in the name of a cloud, remember that the former merely means high, and the latter broken. Alto-stratus clouds, therefore, are high stratus, and fracto-cumulus are wind-broken cumulus.

In general, the cumulus and the cirrus clouds are classified as fair-weather types, while the stratus and nimbus are associated with rain or snow. Rain generally falls from the gray nimbus clouds, but it may also occur with cumulo-nimbus and sometimes with strato-cumulus. In winter, alto-stratus clouds may produce snow, but only on rare occasions will rain fall from them.

However, a better guide to weather changes is found in the sequence of the clouds—since, as bad weather approaches your locality, the clouds normally form in a definite order. First to appear after a period of good weather are the cirrus clouds. Blown along at speeds that sometimes exceed 200 miles an hour, and at heights as great as 50,000 feet, they often precede the center of an approaching storm by several days. If the



You don't have to have one of these to forecast the weather, though the Coast Guard finds it handy for recording weather-balloon data





STRATUS CLOUDS form a layer above warm air, at about 2,000 feet and may thicken to a formless mass

By CARL WARDEN

wind is blowing thin cirrus wisps from the northwest or the west and the sky is a bright blue, look for fair weather to continue for twenty-four hours or more; but if the cirrus clouds are developing into a translucent blanket, rain or snow generally follows.

Trailing cirrus in this parade of the clouds is the stratus variety, the commonest of all. When these clouds form their gray cover over the sky, it is usually a sure indication that a storm is on its way toward you. Eventually, unless the wind shifts into the west, they normally thicken to form nimbus or rain clouds.

As the storm center progresses and passes over you, the nimbus formation will break up and the skies will clear. The next morning probably will be cloudless. Soon, however, the fourth basic type, cumulus clouds, will begin to form against the bright, blue sky to complete one cycle of the clouds from fair weather through rain or snow and back to fair weather again.

Cirrus, stratus, nimbus, cumulus—knowing this normal sequence of the clouds gives you a good start in learning to predict the weather. For if you see stratus clouds forming, you know that nimbus or rain clouds are generally next in line. And when nimbus clouds begin to break up, and you sight cum-



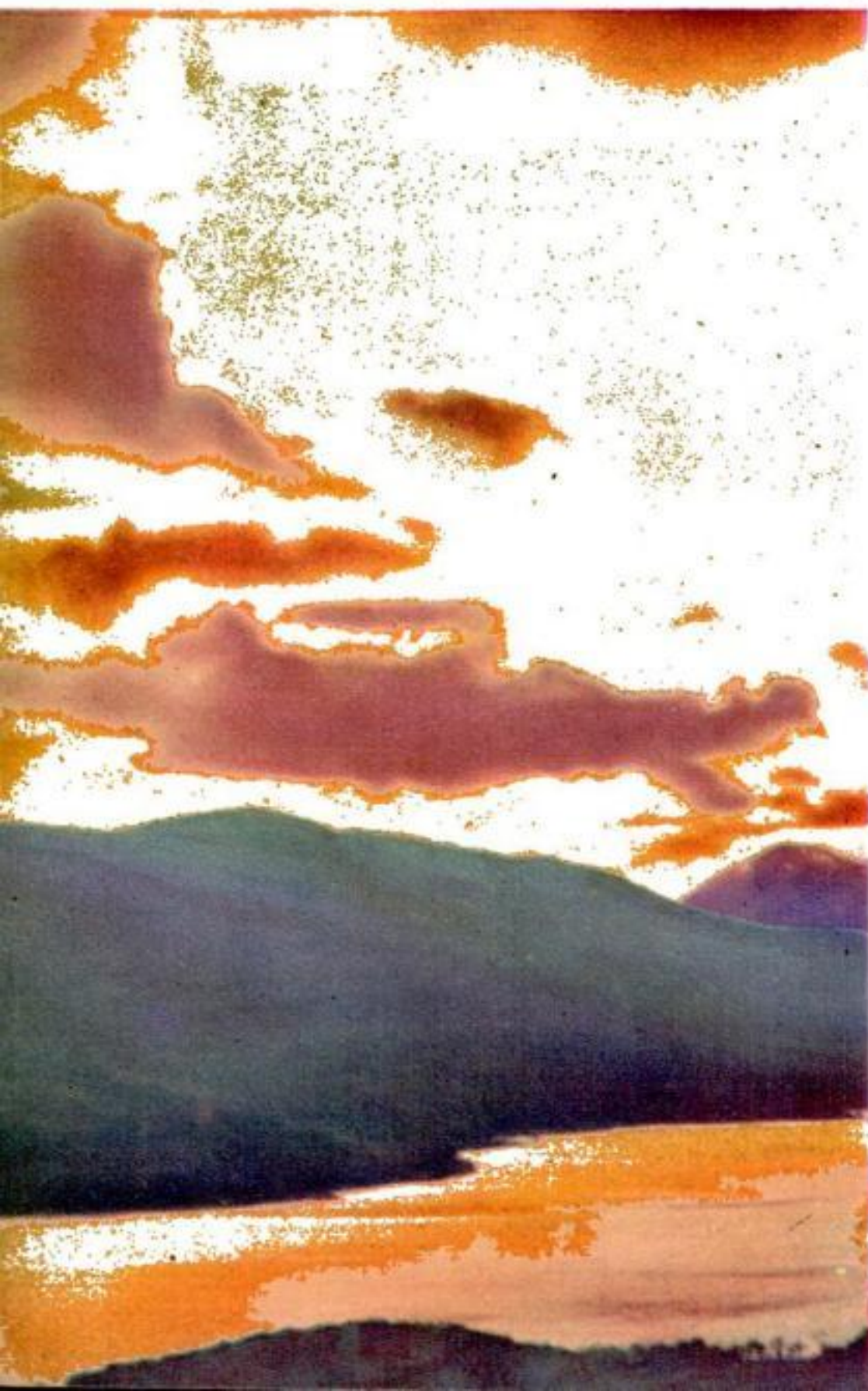
An observer measuring the rainfall for a twelve-hour period in a rain-gauge cylinder

ulus puffs through the holes the wind has torn, it's a good bet that clear weather is on the way. However, there are exceptions to every rule, and if you see huge mounds of cumulus clouds lying close to the horizon in



CUMULO-NIMBUS. Most spectacular of all clouds is the "thunderhead," the familiar storm cloud of spring and summer. It holds the makings of a first-class thunder-and-lightning storm

A **RED SUNSET**, like the one pictured below, is popularly known as a harbinger of fair weather, as in the old rhyme: "Sunset red and sunrise gray, lights the traveler on his way"



the direction from which the wind is blowing, expect a storm within a comparatively short time.

But clouds can serve the amateur weather forecaster in other ways. They may give you tips about what the temperature will be. For example, if clouds disappear from the sky at nightfall, the temperature probably will drop during the night. And if thin cirrus clouds, nicknamed "mare's-tails," are blowing across the sky from the north, fair and warmer weather is on the way.

The clouds can also serve as a weather vane to tell you the direction of the winds, which form another important factor in weather prediction. To use them for this purpose, always look at them in relation to some object on the ground—a church steeple, a tall tree, or the corner of a building. Observe those flying directly overhead, for perspective may fool you if you concentrate on the clouds near the horizon. And if cloud movements are very slow, support your head firmly against a solid object to make sure that it is the *clouds* that are moving in a certain direction, and not your own eyes.

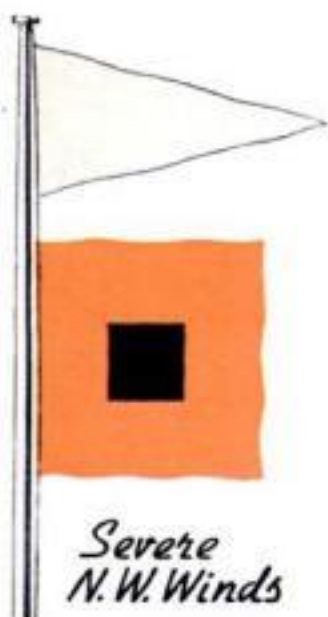
In general, north and west winds are associated with fair weather,



CIRRUS CLOUDS are wispy "mare's-tails" that float at a great altitude. They generally approach from a direction about forty-five degrees to the right of the center of a coming storm

CUMULUS CLOUDS, lying in huge mounds toward the horizon to windward, indicate a probable storm





and south and east winds with rain and squalls. An enduring southeast wind, particularly on the east coast, is a sure sign of rain. But the shifting of the wind from one direction to another is the important point for a weather forecaster. For when gentle westerly winds begin to swing around into the south and east, it is a fairly reliable

indication that a storm center is on the way. Conversely, a shift in the opposite direction is a good sign, for if the wind is blowing from almost any direction and then shifts into the west, the approach of a period of good weather is practically an assured fact.





But why does the shifting of the wind have a bearing on weather changes? To understand that, first glance at the weather map reproduced on page 71. Maps like these are issued daily by the U. S. Weather Bureau and are mailed to anyone for a nominal sum. You will notice certain areas marked "high" and others marked "low." As the Bureau

Professional weather men work with records compiled by complicated instruments like the one at the right. Below, taking a reading of a snow gauge

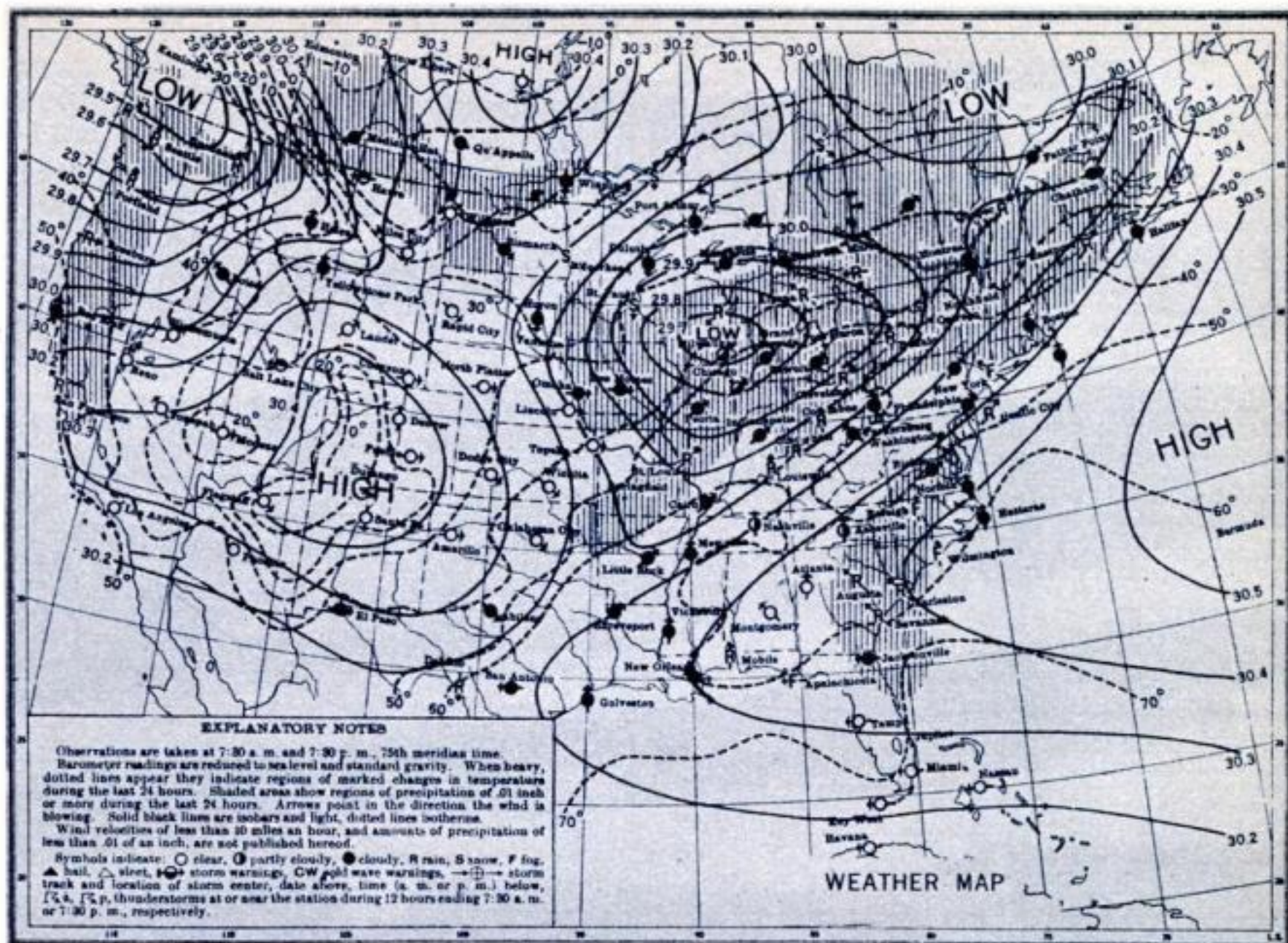


points out in its weather-map explanation pamphlet, "lows" indicate areas where the atmospheric pressure, or weight of the air, is low because of warm, rising currents of air. These "lows" mark the center of general storms, which may cover an area as wide as 1,000 miles. "Highs," on the other hand, indicate areas of high atmospheric pressure and are generally the centers of fair weather. The arrows on the map, which fly *with* the wind—not into it—and show its direction at various observation stations, demonstrate the shifting of the wind.

In the northern hemisphere, winds blow in a general counterclockwise direction toward and around the center of a "low," and clockwise around a "high." Moreover, these pressure centers move across the United States roughly from west to east, traveling at an average rate of about 500 miles a day in

BEAUFORT FORCE	SYMBOL	M.P.H.	CLEW
0	—○	0	CALM 
3	↘○	8-12	GENTLE BREEZE 
6	≡○	25-31	STRONG BREEZE 
7	≡≡○	39-46	MODERATE GALE 

How wind velocity is measured in the Beaufort scale, and indicated on weather maps. Also, how you can estimate it for yourself



WHAT A WEATHER MAP TELLS YOU

The key to the weather is in the low-pressure and high-pressure areas, moving alternately across the country from west to east. "Lows" bring stormy weather; "highs," generally fair

summer and over 700 miles a day in winter, the "lows" normally preceded by warmer temperatures and the "highs" by colder, though not invariably.

Therefore, the wind in your locality is likely to shift into the south or east as a "low," or storm center, approaches you from the west. And when the storm has passed, and a period of good weather is on its way, the wind will tend to shift into the west or northwest.

Generally, rain is most prevalent in the southeast section of these circular storm centers. A daily weather map will tell you pretty accurately whether your locality lies in this southeast sector, but you can establish the fact roughly without this printed aid by applying a law worked out by Buys Ballot, a famous Dutch meteorologist: When you stand with your back to the prevailing wind, atmospheric pressure will generally be lower toward your left and higher toward your right. That means that if a "low" is approaching and you are standing with your back to a southwest wind, the center of the "low," or storm area, will be toward your left, and you will therefore be in the "low's"

southeast sector where rain is more prevalent.

Numberless variations on this sequence of clouds,

winds, and temperatures are possible, of course, but figuring them out forms part of the duties of the professional and much of the fun of the amateur weather forecaster. The official weather experts have the advantage of long years of scientific training, plus a host of valuable meteorological instruments, such as barometers, wet and dry-bulb thermometers, automatic weather balloons, and theodolites. But from accurate observations of the clouds, in addition to wind directions and temperature changes, you can sometimes make a better prediction for your immediate locality than the U. S. Weather Bureau, although their batting average over a long period and over wider areas is bound to be better.

As you become more and

*Severe
S.E. Winds*

more proficient in your forecasting, buy a small pocket notebook and keep an accurate day-to-day log of your observations. Make notes on the cloud formations, the temperature, the direction of the wind, and the amount of rain, snow, and hail. After a period of a year or so, your log will provide you with a complete history of the weather in your locality and, by allowing you to compare present conditions with past performances, will help you to read weather clews more accurately.

Don't expect to gain fame as a weather prophet the first week you make predictions. For, in addition to a good working knowledge of the whys and wherefores of weather,

you must learn to make accurate observations and then draw the correct conclusions from this evidence you find in the sky. That takes practice—but so does everything else. Good luck to you as a weather forecaster!



U. S. Coast Guard officers releasing a balloon that carries weather instruments and a tiny radio transmitter by which readings are reported. Above, following the balloon's course with a theodolite to gauge the wind.



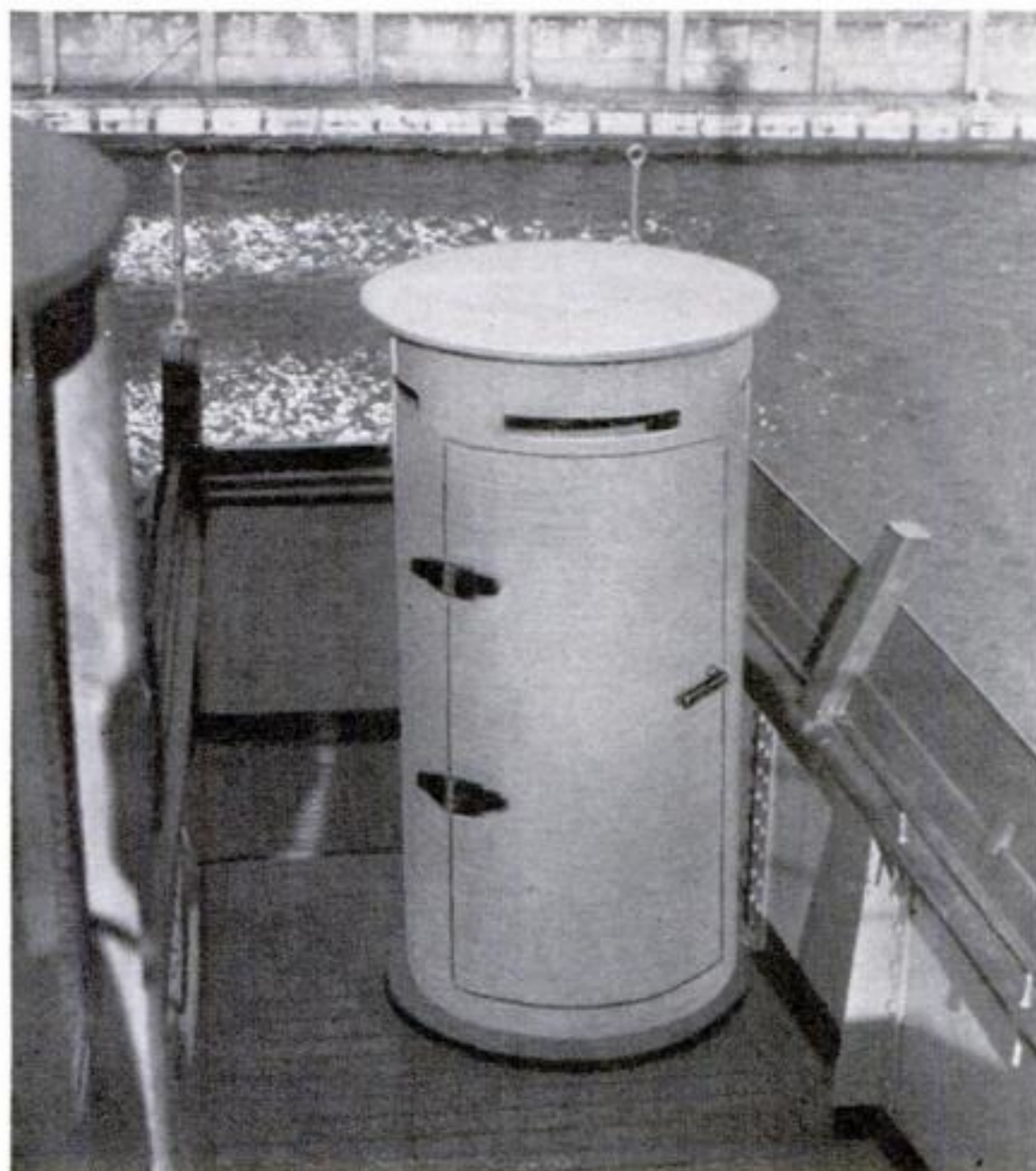


Ernest Messikomer, right, teaching basketball technique with tiny models to a Temple University player

Basketball Players Learn from Models

TINY models of players holding basketballs in various shooting and passing positions are being used by Ernest Messikomer, coach of the Temple University squad, in

Philadelphia, Pa., to instruct his charges in the fine points of the game. The model players are used on a miniature court, complete with backboards and baskets.



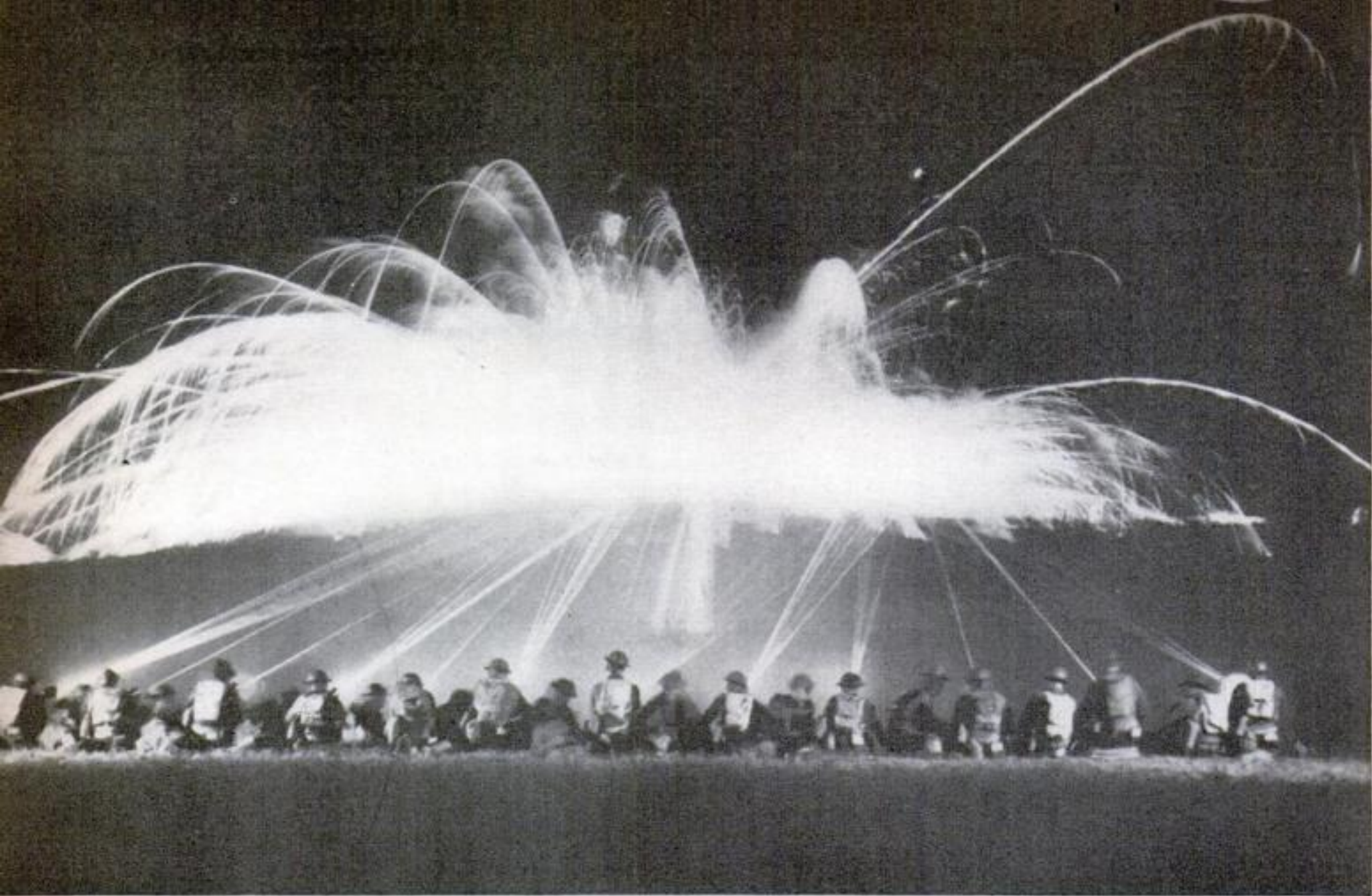
Bulletproof pill box on the bridge of the British liner "Scythia"

British Ships Get Bomb Shelters

TO PROTECT a sailor or officer on watch on the open bridge of the British liner *Scythia*, steamship officials have installed steel pill boxes like that seen in the photograph at the left. Entering by a flush steel door, the watch peers out through slots cut in the steel wall just below the pancake top of the protective chamber.

Cocktails? Just Tune Them In!

"COCKTAILS by radio" may become a reality, one radio authority states. A high-frequency radio transmitter which induces heat in anything placed in the path of its waves will be used to stimulate circulation in the brain, providing a harmless stimulation.



"Fireworks" Flare in Army Maneuvers

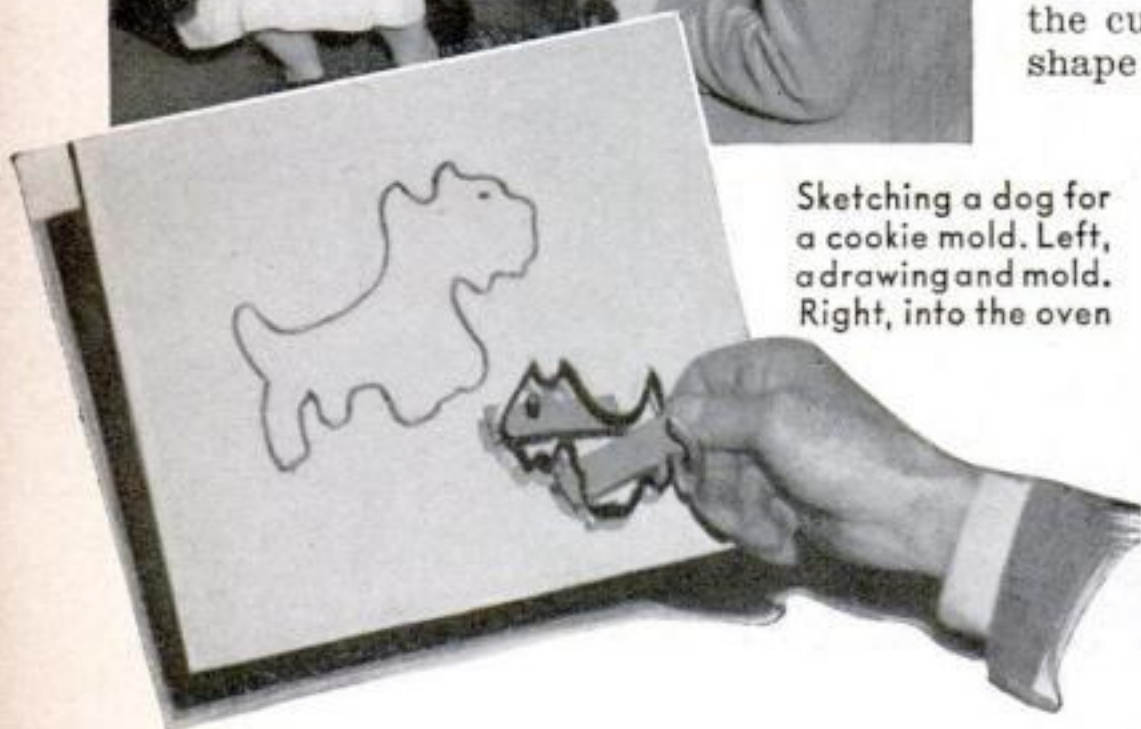
FOUNTAINS of fire blaze up from a dummy pill-box fort in the remarkable photograph shown above, picturing an incident in recent night maneuvers of the U. S. Army at Fort

Benning, Ga. Machine gunners in the foreground are firing tracer bullets while phosphorus bombs fired from mortars explode in great, awe-inspiring blotches of light.



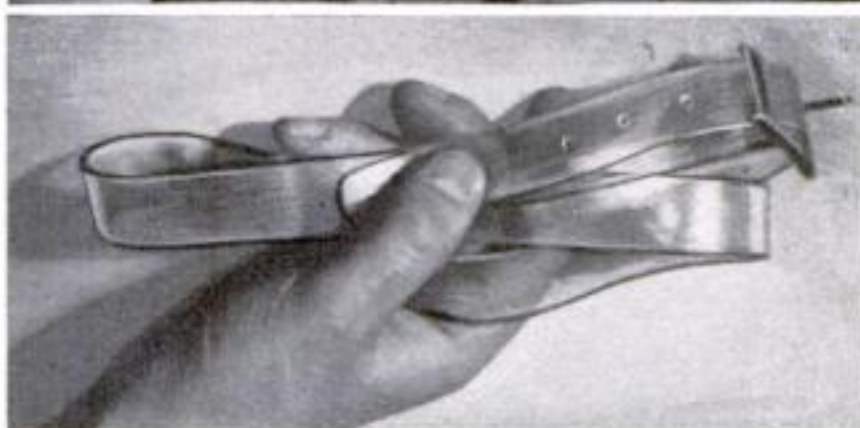
You Can Have Your Pets and Eat Them, Too

COOKIES made in the likeness of the pets of individual customers are prepared by an ingenious Larchmont, N. Y., baker, Rockwood Moulton. From a photograph or from life, Moulton sketches a dog or other pet, makes a cookie mold from the drawing, stamps out the forms in dough, and slides them into his ovens. When they are done, the customer has a batch of cookies in the shape of Towser, Puss, or Polly the parrot.



Sketching a dog for a cookie mold. Left, a drawing and mold. Right, into the oven





Elastic "Glass" Belts Made of Coal and Salt

MADE of coal and salt, a new transparent synthetic-resin material is now being made into novelty belts, suspenders, and garters. Elastic, and said to withstand the effects of age, heat, cold, oxidation, or acids to a remarkable degree, the belts are available in either the transparent form, or in various colors, including black, white, garnet, sapphire, emerald, and brown. In the upper picture the elastic properties are shown.

Portable Two-Way Radio Weighs Five Pounds

SUSPENDED from the shoulders and strapped around the waist, a compact radio transmitting and receiving set, battery-operated and weighing only five pounds, is now being tried out by New York City police officials. A microphone is attached to the vest.



Front and rear views of portable two-way radio. It can be worn underneath a coat



The builder tuning up his model "windmill plane" for a test flight

Gasoline Motor Runs Successful Autogiro Model

ONE of the first of its kind, the diminutive aircraft model shown with its builder in the photograph at the left is patterned after a full-size, cabin-type Pitcairn autogiro. Proved airworthy by a number of successful flights, the model "windmill plane" is propelled by a small gasoline engine which is rated at one fifth of one horsepower.

HOT



BOBSLEDDING offers a thrill in mile-a-minute dashes around banked turns and down icy slopes



HOCKEY calls for lightning speed and perfect control on skates. And, as proved by this shot of a fast play at the goal, it isn't exactly a game for sissies. Below, Roy Shipstad, professional figure-skating expert, shows how you can be an aviator without having to use a plane



STUNTS like this barrel jump through a hoop of flame are easy if you know how

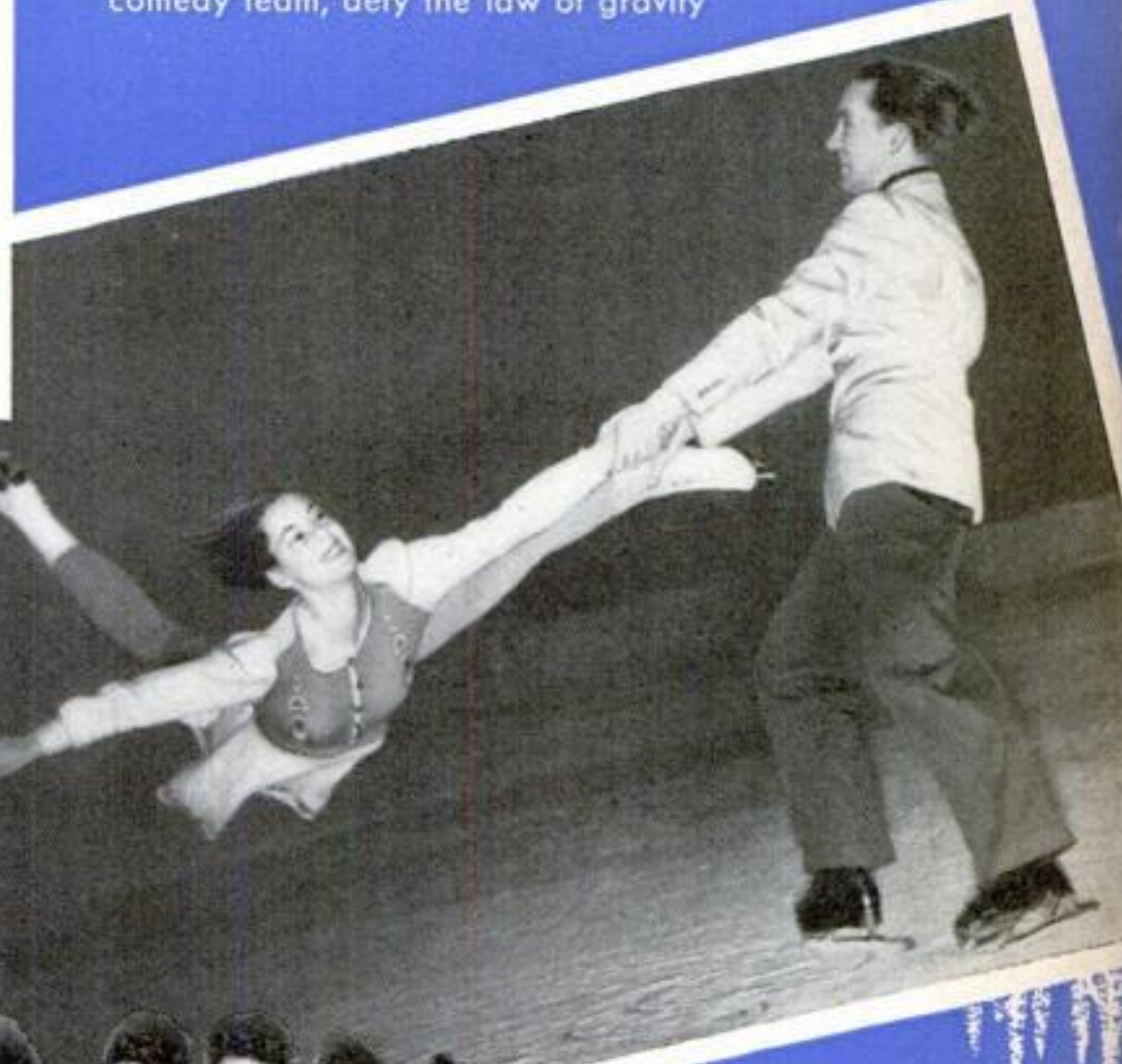


STUFF ON ICE

ACROBATICS. Rube and Bobby Maxson, of Duluth, Minn., trying out a stunt



COMEDIANS on skates work hard for laughs. Here Frick and Frack, a Swiss comedy team, defy the law of gravity



CONFIDENCE. Before trying to do this, you'd better practice it a few times with just the bales of hay. Then ask for volunteers

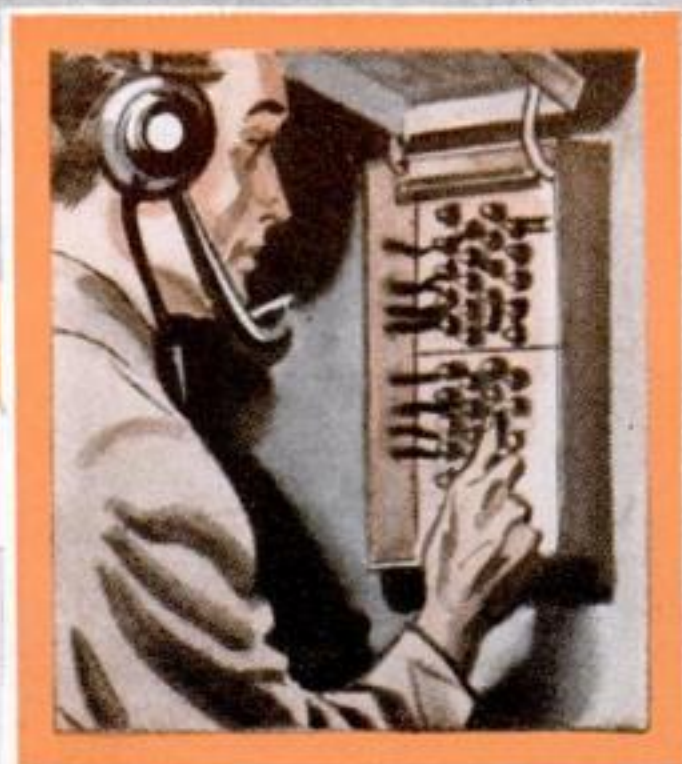


AIRPLANE SPIN! Here is Roy Shipstad again, performing a graceful but difficult trick with Bess Ehrhardt in New York's Madison Square Garden

Can Mines Conquer



OFFICER SETS OFF MINE
BY PRESSING BUTTON



Submerged harbor mines, controlled electrically from the shore, are set off in groups as enemy ships steam across them

WHAT can be done about the war menace of submarine mines? How are they laid? What kinds are there? Why do the U. S. Army and Navy use different types? Answers to questions like these, which headline readers are asking today, present a revealing picture of the modern art of mine laying.

"Observation mines," planted in a harbor entrance and fired electrically from the shore, fulfill a purely defensive mission. Together with mighty coast-defense guns, they bar passage to enemy ships attempting to enter a port. Moored in three or more rows, six to ten feet below the surface, these forty-inch globes hold 200



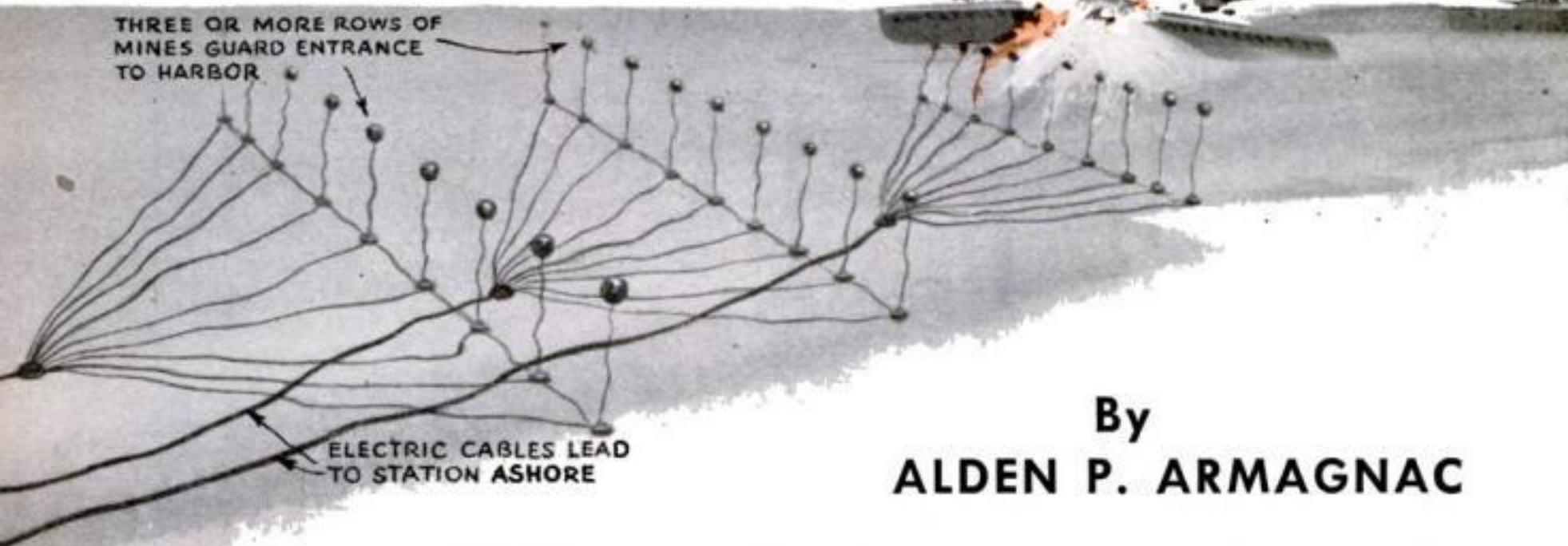
Planting a harbor mine in a recent test by the U. S. Army. This is a forty-inch

pounds of T.N.T. apiece. Submerged wires link them to the firing station. A friendly vessel may bump squarely into one without harm. But a pair of observers with telescopes, in hidden vantage points ashore, quickly converge their telescopes upon an approaching enemy warship. Just as the unsuspecting invader passes over the charted position of a mine, they give the signal to fire. Pressing an electric button explodes the charge, disabling or sinking the hostile craft.

The mines may be fired singly or in whole groups at a time, as circumstances require.

With the aid of little slate-gray vessels called mine planters, all U. S. observation

Sea Power?



By
ALDEN P. ARMAGNAC



A dummy ship goes up in smoke as a mine explodes in a demonstration by the Army at Old Point Comfort, Va.

mines are laid by the Army. Few military secrets are more jealously guarded than the technical details of harbor mining. But civilian observers recently were permitted a glimpse of its effectiveness in an Army demonstration near its submarine mine depot at Fort Monroe, Va., in which a miniature target representing a ship was blown to bits as it was towed through a practice mine field.

"Contact mines" and related types, in contrast with "observation mines," explode automatically when a ship strikes them. Mines of this sort are laid by our Navy. A self-acting anchor, containing the mooring cable, accurately fixes the distance of the mine below the surface regardless of sea depth. They may be used defensively, in carefully charted mine fields with secret gaps, to keep enemy ships out of home waters; or offensively, to blockade an enemy's ports or sea outlets completely. Horned mines, antenna mines, magnetic mines, the unmoored Leon mine, and acoustical mines illustrate the diversity of present-day naval types, which contain on the average about 300 pounds of T.N.T.

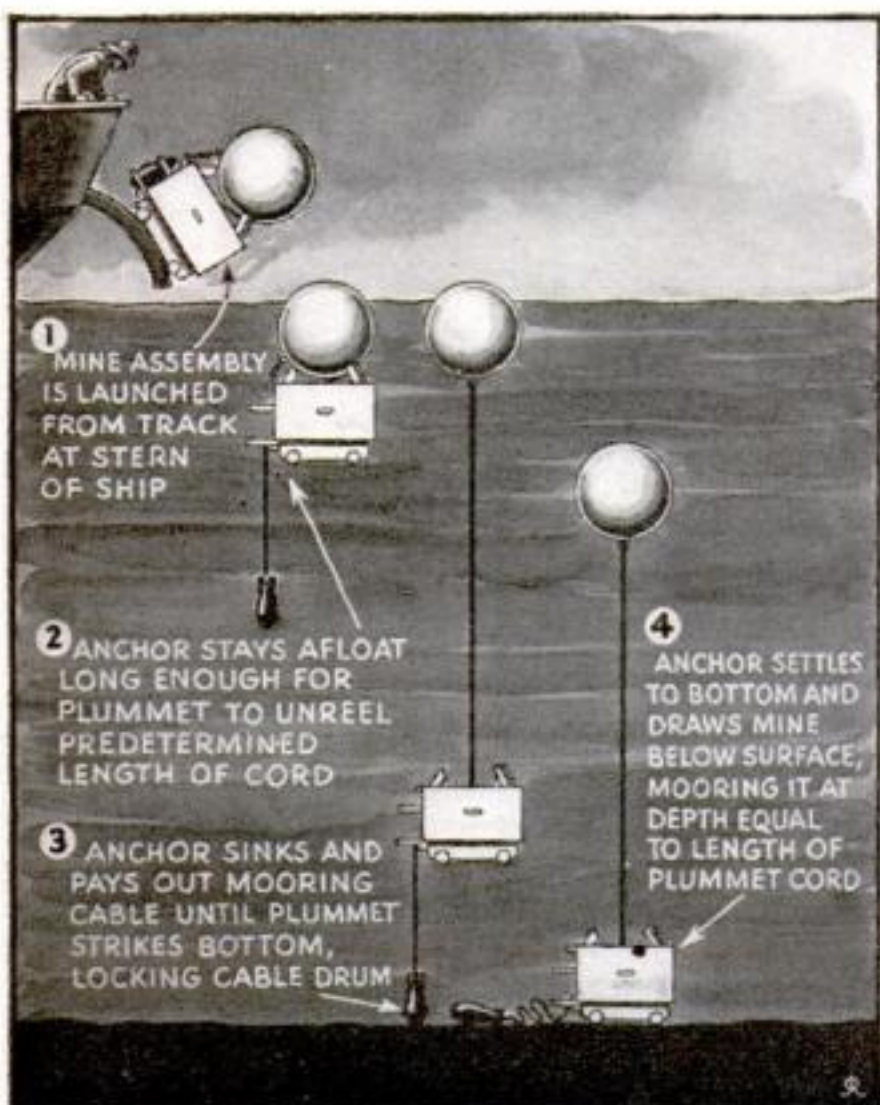
Five-inch leaden fingers, projecting from the globular or pear-shaped casing of a typical horned mine, serve as its triggers. When a ship's hull strikes one, it breaks a glass vial within, spilling a chemical solution into a cup containing zinc and carbon strips. This forms an electric



Naval contact mines on a track at the stern of a fast U. S. destroyer, waiting to be dropped into the water. Such vessels as this can mine an enemy seaway, or lay a defensive screen off their own coast

battery, energizing the firing mechanism and instantaneously exploding the mine.

Antenna mines, first introduced by the U. S. Navy, multiply the effective range of



How a deadly submarine mine can anchor itself at a predetermined depth beneath the surface of the sea

the "trigger" mechanism. Above the mine, a float supports a long vertical copper wire. When the steel hull of a submarine or surface ship touches the copper, the galvanic action of the dissimilar metals sets up a faint electric current, and a supersensitive electric firing device detonates the mine. It was the greatly increased danger zone of the antenna mine that made possible the famous North Sea Barrage of 1918—an enormous curtain of 70,000 mines, stretching from Scotland to Norway, that bottled up German submarines. A new British adaptation of the device may be used in a current Admiralty plan to lay a defensive belt of no less than 200,000 mines, eight miles offshore, along the entire east coast of Great Britain.

Magnetic mines, such as Germany is reported to be laying, employ another method to increase their range. Approach a compass with a steel bar, and the magnetic needle will be deflected. By applying the same principle, the firing mechanism of a magnetic mine is set off by the steel hull of a ship.

Self-supporting at any depth, the Leon mine of Swedish invention offers a particular hazard because it has no mooring cable that a sweep wire can catch. An electric-powered propeller maintains it midway between surface and bottom until its storage battery is switched off or exhausted.

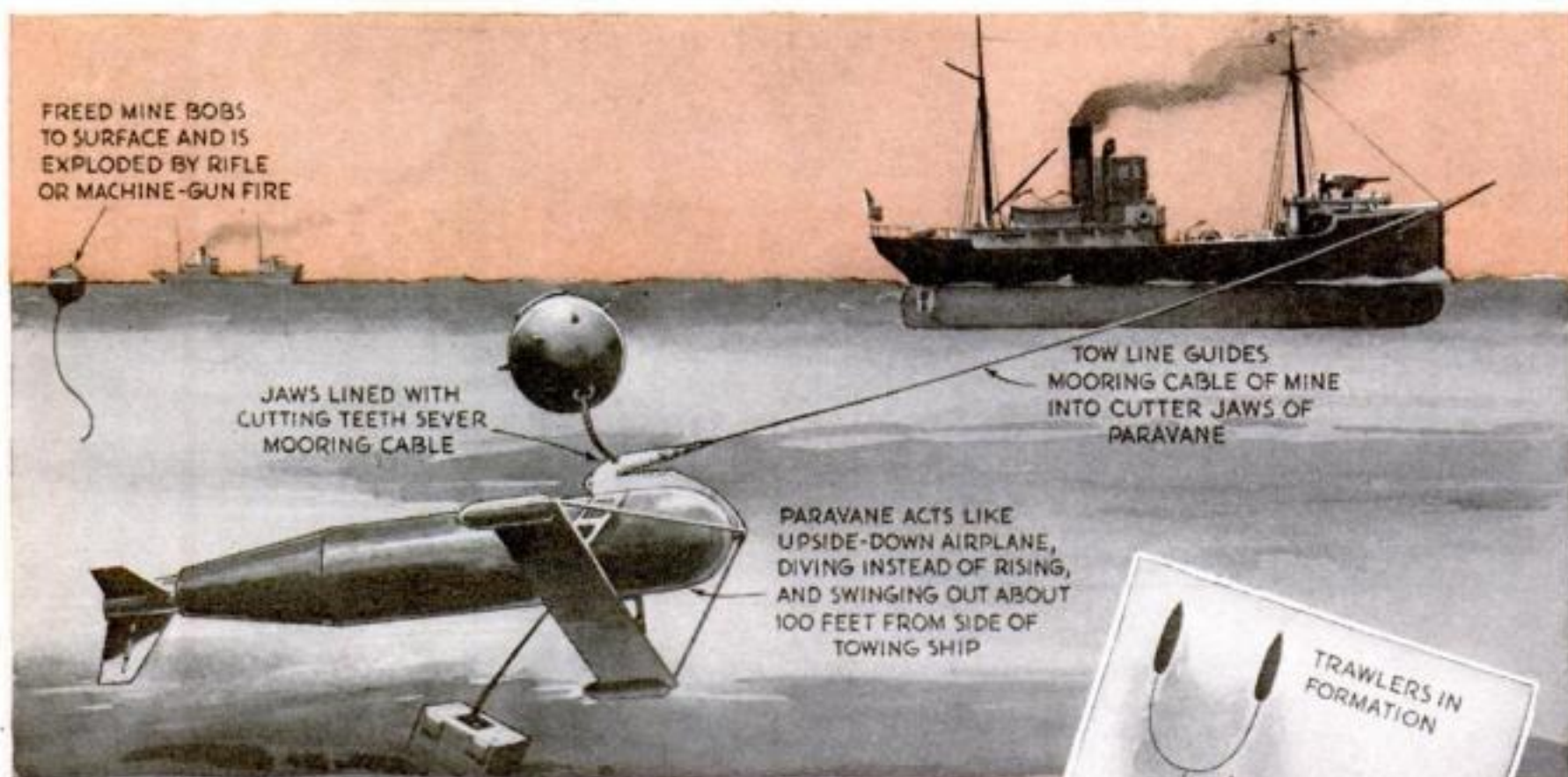
Mines fitted with acoustical horns, and



THEY RISK LIFE TO CLEAR THE SEAS
British mine sweepers maneuvering into position. Dragging paravanes or sweep wires to cut mooring cables, they work in constant peril. At right, planting a flag buoy to mark a cleared channel



These are German mine sweepers in action. Note the anti-aircraft gun ready to repel attacks



Two ways of sweeping for mines. The drawing above shows how a paravane snags the mooring cable and severs it by means of its powerful cutting jaws of hardened steel



Mines that bob up to the surface with their moorings cut are exploded by rifle fire

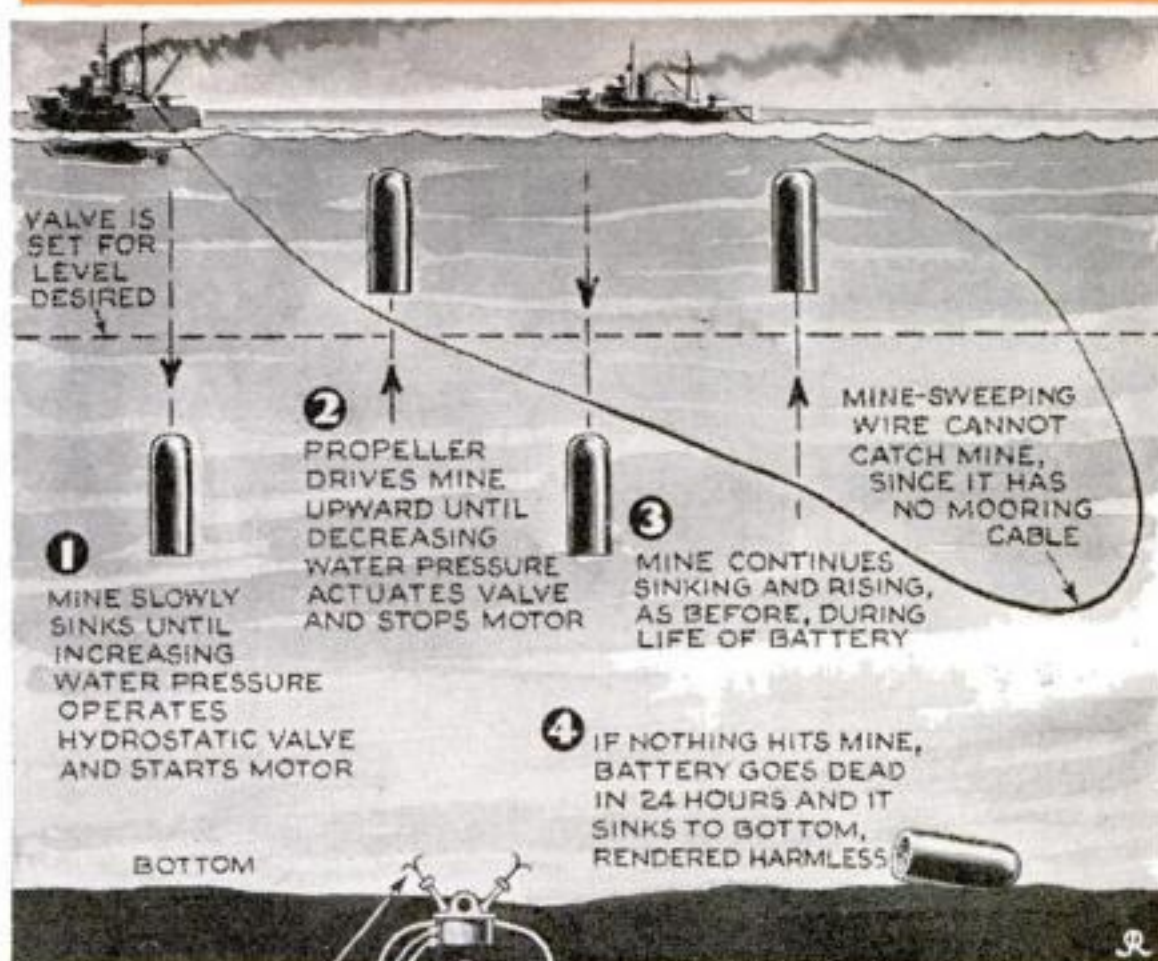
intended to be fired by the sound of a passing ship, are said to have been found recently in British waters and recovered intact for examination by experts. Developing the idea, an American inventor proposes a torpedo-shaped, self-propelled acoustical mine that would rise from a shallow bottom and follow the sound until it scored a direct hit upon the ship.

From beneath the sea, from surface ships, and now even from the air, naval mines may

be sown. For the first time in the history of warfare, Germany has introduced the innovation of parachuting mines from planes—probably torpedo-carrying aircraft adapted for the purpose. According to some reports, the parachute serves to break the fall of the mine and prevent a premature explosion when it strikes the water. But tor-

pedoes may be launched from planes with no such precaution, and it seems likely that the parachute has a more important object. The curved trajectory of ordinary missiles dropped from a speeding air raider would make accurate placement difficult for a mine-laying plane, twisting and turning to dodge coast-defense searchlights and anti-aircraft guns. A parachute, however, would immediately check the forward motion of a released mine and drop it almost squarely beneath a low-flying plane criss-crossing a harbor channel or estuary.

Submarines, fitted as mine layers, can also carry mine attacks into an enemy's own harbors. They launch their mines horizontally through



SHIP EXPLODES MINE EITHER BY CONTACT WITH ANTENNAS OR BY JARRING "INERTIA" FIRING SWITCH

300 POUNDS OF HIGH EXPLOSIVE

ELECTRIC DETONATOR AND "BOOSTER"

STORAGE BATTERY

MOTOR SWITCH

ELECTRIC MOTOR

HYDROSTATIC VALVE

PROPELLER

The ingenious Leon mine is moved up and down by a battery-powered motor

stern tubes, or vertically through wells built into the craft. Like airplanes, they suffer the disadvantage that they can carry only a limited number of mines.

Can mines and mine layers of the latest design cripple a warring nation's sea power and its ocean-borne commerce?

Daring crews of tiny mine-sweeping craft appear so far to be fighting a winning battle against them, with the aid of equally ingenious counter-weapons.

One of their principal aids, the Burney paravane, resembles a model-size airplane. Its vanes are set so that it will swing wide of the ship when towed beneath the water. Men aboard the vessel feel jarring vibrations and hear a terrific grinding noise as the tow line encounters and scrapes along the mooring cable of a mine. A moment later, the cable is guided into powerful jaws that cut it in two. The loose mine is then exploded by rifle or machine-gun fire.



DETONATOR

HIGH EXPLOSIVE

COMPRESSED AIR TANK

FUEL

EAR

EAR

INTERNAL-PRESSURE CONTROL

DIRECTION CONTROL

PROPELLER SHAFT

PROPELLERS

EYEBOLT

RUDDER CONTROLS

An American inventor proposes this torpedo-type mine, to be guided to its target by sound

Sherlock Holmes of Furs

A FEW weeks ago, an excited woman rushed into a New York City department store, accompanied by her lawyer. Like a crimson scarf, a red rash extended around her neck. It had forced her to cancel a southern trip. She threatened to sue the store for \$100,000 because, she declared, dyes in a fur coat purchased there had caused the trouble.

The manager swung around to his telephone and rang the midtown laboratory of Max Bachrach. Bachrach is the Sherlock Holmes of the fur industry. His studies, begun years ago as a hobby, have made him world famous. An hour later, surrounded by chemicals, microscopes, and special lights, he was bending over the coat. And before nightfall he had solved another mystery of the fur world.

Extracting some of the dye, he proved it harmless. Along with it, however, he obtained some mysterious chemicals which he identified as ingredients of a costly perfume. They, also, were non-irritating. The answer to the riddle was a curious chemical reaction resulting from contact between dye and perfume. When the woman switched to another brand of perfume, the rash disappeared. Bachrach's test tubes had saved his client the cost and trouble of needless litigation.

In literally thousands of other cases, during the last dozen years, his scientific detection methods have revealed frauds, decided lawsuits, and cleared up riddles. Clients from as far away as New Zealand and Afghanistan have sent him problems to solve. He is consulting specialist for the Federal

By
ROBERT E. MARTIN



UNDERLYING FUR HAIRS

When you buy fur, try this test. A good pelt has a thick growth of underhairs



SCIENTIFIC SLEUTH SPLITS HAIRS FOR CLEWS TO SKIN GAMES

Trade Commission, U. S. Customs officials, and the New York State Board of Health. He has made special investigations for the famous Hudson's Bay Company and at least one of the royal families of Europe. Years of research have made him a unique institution—a sort of one-man court of appeals in the fur industry.

Not long ago, two veteran New York furriers argued for nearly a week over a dark-brown coat. One was positive it was made from Japanese mink; the other was equally sure it was formed of Kolinsky mink from Russia. They appealed to Bachrach. He found it was neither. It was fur from a mink native to China!

When Bachrach began fitting himself for his present specialized work, he studied analytical chemistry; he did special research in microscopy at Columbia University; and he carried on extensive researches in hairs, fibers, and skins. In addition, he mastered the whole intricate science of fur dyeing.

Max Bachrach at work. His word is law to furriers who seek his services to establish final proof of fur qualities. Lower, photomicrograph of water-soaked skin which will soon wear out

Today, if you hand Bachrach a single hair pulled from a fur coat, he can put it through a scientific third degree and tell you not only the kind of animal that produced the hair, but the part of the world in which it lived, the season of the year in which it died, and almost what it was accustomed to eat for breakfast!

More than 5,000 microscope slides, housed in special steel filing cases, aid Bachrach in his work. For, much of his time is spent splitting hairs in search of clews. Cross sections and lengthwise slices, he reports, pre-

sent telltale patterns that enable him to discover vital facts about the animal that produced the hair. So delicate is the microtome he uses for dissection that it will cut a hair lengthwise into half a dozen slices, each only 10/25,000ths of an inch thick. Magnified 800 times, the inner pattern of these slices, as well as the scales of the exterior of the hair, show characteristic differences. A quick comparison with Bachrach's "fur-fingerprint" file, said to be the largest of its kind, establishes the identity of the animal and the place from which it comes.

It was this file, not long ago, that tripped up one of the cleverest fur counterfeiters in the country. Using turkey feathers for brushes and special wood dyes as a coloring medium, this artist changed a coat made of relatively inexpensive Baum-marten skins into an almost perfect imitation of a priceless Russian sable garment.

To do this, he dyed only a small portion of the pelts. All fur-bearers have two kinds of hair: the longer, stiffer "guard" hairs, which shed water and act as a raincoat, and the finer, softer fur fibers, which grow rapidly in place at the approach of winter and protect against the cold. By dyeing only the tips of the guard hairs, the counterfeiter produced the desired effect. So clever was the fraud that the coat passed muster before several experts before a suspicious dealer brought the garment to Bachrach.

Sometimes, in presenting an important case in court, he will have to make as many as 200 photomicrographs to prove his point. At other times, he has to spend days mix-

ing chemicals in his laboratory to learn the exact ingredients of an unknown dye. The worst instance of this kind he ever encountered grew out of a fur coat that faded the first time it was sent to the cleaners. The owner demanded a new coat. She maintained that too strong a cleaning compound had been used. Bachrach was called in.

AS SOON as he began analyzing the dye that had been used, he discovered it was like unraveling tangled yarn. The original dyer had thrown chemicals together until he had the shade desired. There were half a dozen unnecessary ingredients in the concoction and, more than that, a metallic salt had been included that crystallized on the outside of the hairs and prevented the dye from staining the interior. Consequently, when the garment was placed in the sawdust "tumbling" cylinders at the cleaners, part of the crystallized dye was scraped off and the fur came out a lighter hue. The dyer and not the cleaner was responsible.

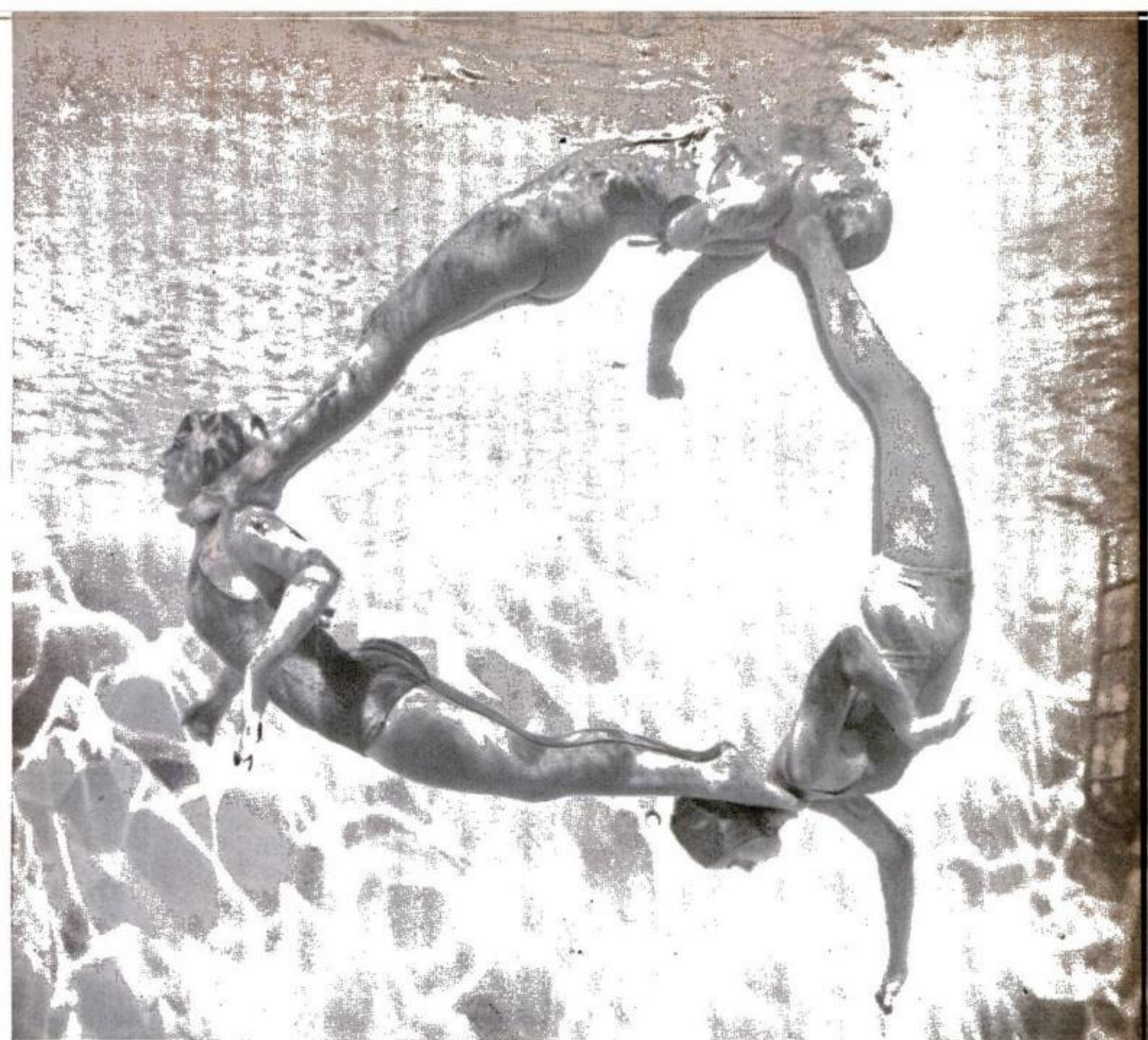
In connection with the color of fur, Bachrach has noticed a peculiar thing. The character of the soil affects the hue of the pelt. In parts of the Northwest Pacific Coast, for example, where the soil is reddish, fur-bearing animals have a pinkish cast not found in regions where light or sandy soil is the rule. Diet also alters the character of the pelt. Thus, Bachrach can distinguish a northwestern otter from one trapped in New England, or a mink caught in Minnesota from one that lived in the Canadian wilderness.

In times past, identification of furs was largely a matter of personal opinion based on experience. Bachrach's scientific-detective methods have changed that. With his test tubes, his microscopes, and his "fur-fingerprint" file, he has supplanted debatable opinion with scientific proof.



Above, testing with acetic acid and vanillin for organic dyes in a fur sample. Right, another test, made to indicate whether a fur piece was properly cured





Girl Swimmers Form Human Pin Wheel

SNAPPED through a window in the side wall of a swimming pool, the curious photograph above pictures an underwater pin wheel formed by three girl swimmers during a

recent exhibition at Palm Springs, Calif. Each girl locked her feet around the neck of another swimmer, while all three used their arms to dog-paddle the trio around in a circle.

Stamps Depict States on Decorative Screen

POSTAGE stamps outline the forty-eight states of the United States on a map of North America that forms part of the central panel of a decorative screen recently placed on the market. Canadian and Mexican stamps and those of other countries are mounted in their proper places over the remainder of the continental map. Other panels bear paper stamps with the insignia of various states.





Trailer Makes Gas from Coal To Drive Car

TRUNDLING along on its two rubber-tired wheels, a curious trailer makes the fuel to propel the vehicle to which it is attached, in a novel system recently introduced in England as a means of conserving gasoline for military uses. Mounted on the small trailer is an apparatus that generates combustible gas from anthracite coal or from coke. The gas is drawn from the trailer through pipes to the motor of the vehicle ahead, thus enabling buses, trucks, and cars to make their own



A London bus hauling a trailer on which gas is generated from coal or coke for fuel. Upper left, a close-up of the trailer

fuel while under way. A similar type of gas-generating apparatus is designed to be attached to the fronts of vehicles. A London bus is shown above with its trailer.

Model-Railway Roadbed

PACKAGES of imitation earth are now available for use in making realistic roadbeds for model-railroad lines or for paths in miniature gardens. A moss product, the substance is harmless if children swallow it.



Packaged imitation earth makes a realistic roadbed



Chains Built into Tire

CORRUGATED spiral springs are built into the tread of a new nonskid tire for winter use developed by D. E. Crooker, of Ontonagon, Mich. When the tire expands under the load of a car, the springs are thrust part way out of the tread to grip the road and dig into ice or packed snow.

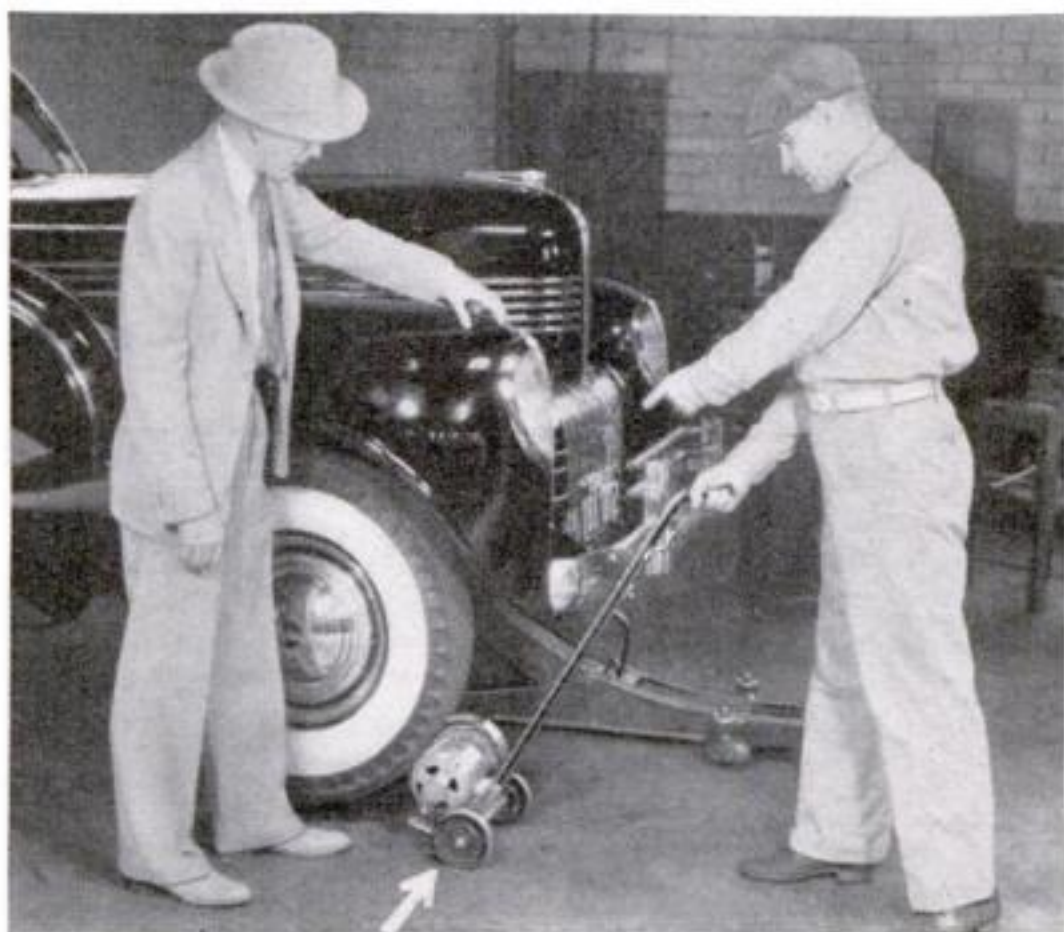
Children Build Tunes with New Musical Kit

BY ARRANGING metal sounding bars in the proper order, a child can play ten familiar tunes with a new "musical construction kit." Numbered according to pitch, the bars are selected from racks and set up in a row, in the same order as numbers on a song sheet. Striking each key in turn, from left to right, plays the tune. Budding composers may also work out melodies of their own, and jot down the sequence of numbers on blank charts so that they may be repeated at a later date.



Pup Aids Pilot in Take-off

"SLIPSTREAM," the intelligent dog shown above, superintends his master's take-offs from the Coast Guard air base at Floyd Bennett Field, New York City. At a signal from Lieut. Charles Tighe, he yanks away the wheel chocks for a take-off.



An electric motor spins the jacked-up car wheel at high speed

Odd Tester Detects Car-Wheel Wabbles

RESEMBLING a miniature lawn mower, a new electric appliance speedily detects an unbalanced or wabby car wheel, and dispenses with a time-consuming road test. Rolled under a tire, it spins the jacked-up wheel at speeds of from eighty to 100 miles an hour while the car is standing still. Thus a mechanic can closely observe, under the most favorable circumstances, what adjustments may be required, and point them out to the owner as shown at left. The novel aid operates on either direct or alternating current, and is said to enable a thorough test of wheel balance to be made in three to five minutes.



C. B. Perkins knows snakes from A to Z

SOME snakes will chase human beings. All reptiles that have eyes with elliptically shaped pupils are poisonous. Certain snakes can milk cows, swallow their young, roll along the ground like barrel hoops, or even outdistance a race horse.

At one time or another, every one has heard one or more of these statements made. Some persons say with all sincerity that they have actually seen one of these reptilian phenomena occur—"with my own eyes." Constant repetition has led many to accept these snake stories as established fact.

But are any of them actually true, or are they all mere legends and misconceptions?

To provide a straightforward, and fully reliable reply to this query, the editors of *POPULAR SCIENCE MONTHLY* put the most widespread of these snake stories up to C. B. Perkins, curator of reptiles at the San Diego, Calif., zoo. For more than thirty years he has been a close student of the habits of snakes of all species, from diamond-back rattlers and giant boa constrictors to tiny six-inch worm snakes. Here are his answers.

Snake Myths

SMASHED BY SCIENCE

Do snakes sometimes swallow their young to protect them from attack?

A HUNGRY king snake might eat the young of another snake, but for breakfast, not for the little ones' protection. If you happened along at about that time and observed the process, the evidence "before your very eyes" might convince you that the snake was swallowing its offspring for fear that you would attack them. Or if you met a female rattlesnake and beat it to death with a club, fearing that it was about to strike, you might force out some unborn young. In the excitement, you might conclude that the youngsters emerged from the rattler's stomach. You'd be wrong. Snakes do not swallow their young to protect them.

Is it a stinger that a snake thrusts out of its mouth and waves around?

Can any snake sting or poison its prey with its pointed tail?

THAT forked ribbon which emerges from a snake's mouth, sometimes with rapier-like thrusts, is nothing more nor less than a tongue. It is not an instrument of either aggression or defense. It carries no poison, and its touch is so delicate that you cannot feel it against the palm of your hand, although you might feel it against the back,



since the hairs there are more sensitive than your bare palm. Snakes inject poison with their fangs, not their tongues. A rattlesnake will, when angry, project its tongue perhaps two inches, waving it excitedly up and down. In fact, a rattler may betray nervousness and excitement by waving its tongue some time before it begins to sound its better-known and more ominous warning. No, snake tongues are harmless, and so are snake tails. The tails of more than one species do end in a conical scale, coming to a point that closely resembles a "stinger." The bull snake is one example. Hunters have reported squeezing the tails of reptiles killed along the trail until "a stinger like that of the velvet ant or a bee appeared." Their observation was correct, but their conclusion faulty. They saw a conical scale, not a stinger.

Are there any nonpoisonous snakes in this country that are dangerous because of their great size?

NO. The largest varieties are the bull snake, also known by many other names, and the indigo, a mild-tempered serpent found in the Southeast. If any of these fellows is near enough to you and ready to bite, you may as well stand and take it, for he'll probably get you anyway. The bite is like several pin scratches. A little iodine over the spot will prevent any infection.

Do racers sometimes use their bodies to whip persons who catch them?

THIS yarn probably started with some one who ounce caught a whip snake, or racer. While he held it, the snake undoubtedly twisted and writhed, throwing itself into a frenzy of movement, and its tail struck against the captor's legs or body. But not severely. Were I literally to whip you with a snake, the snake would die. Racers are not in the habit of thus committing suicide. You may be sure that when a snake whips a man, it hurts the snake more than it does the human victim.



You don't need to worry about ever being whipped by a snake

Is there any rule for telling whether a particular snake is deadly?

It has often been said that all snakes born alive are poisonous, and all snakes hatched from eggs are nonpoisonous.

WELL, the garter snake is born alive and is completely harmless. And the coral snake hatches from an egg and he's poisonous. You can't be sure even from the appearance of a snake whether it is poison-

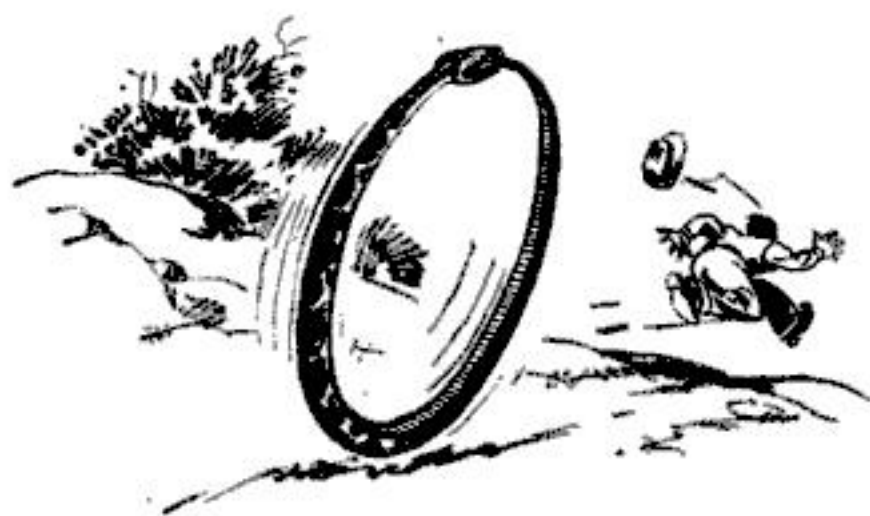


Reptiles hatched from eggs can be poisonous, too

ous or not. Small neck and large head do not necessarily connote poison, as some people believe. Some snakes having eyes with elliptically shaped pupils are only mildly poisonous, such as the lyre snake found in Texas, Utah, Nevada, Arizona, and California. Pit vipers—moccasins, rattlers, and copperheads—have elliptical pupils and are very poisonous. The coral snake has round pupils and is poisonous, but the round-pupiled boa is not. Ordinarily, the whirring rattle identifies the rattler, but the sound might come from some harmless snake moving among dry leaves. Again, a rattler may have lost its rattles by accident, and therefore make no warning sound. This loss, however, makes it no less dangerous. No, the best advice I can give is to study the poisonous reptiles inhabiting your locality by observing them in a zoo.

Do snakes ever chase human beings, or attack them without provocation?

UNLESS cornered, no snake in this country is aggressive, and all will attempt to escape. Even the rattlesnake strikes only in self-defense. Once I happened on a blow snake, heard it hissing, and because it was the mating season, I advanced slowly, hoping to observe a pair mating in the wild. Several times, as I moved forward, the snake started toward me, but when I retreated the reptile halted. Not once did it advance after I had moved away to what the reptile apparently considered a safe distance. An inexperienced observer might consider this snake's actions an attack, but it was only a vigorous defense.



The myth of the hoop snake is one of the most popular

What about "hoop snakes" that take their tails in their mouths and roll rapidly along the ground? Are they fact or fiction?

F ICTION, although reports of the appearance of hoop snakes have some slight background of fact. In the southeastern United States there are two kinds of burrowing mud snakes. They are seldom seen, but occasionally freshets wash them out of mud banks into near-by meadows. The reptiles tend to form circles as they lie there in the shallow water. Barring their color, they then resemble the inner tube of a bicycle tire. Here fact ends and fiction begins. Some fanciful soul spots the coiled snake, and his fertile imagination has it rolling overland in no time at all. After the yarn has been repeated a few times, the snakes are rolling as easily as the facile tongues of the story tellers.

Will snakes eat vegetables or fruit?

S NAKES eat animal food only. In most zoos, rats predominate on the reptilian menu, followed by mice, rabbits, frogs, chickens, fish, insects, and earthworms.

Is there really any kind of a snake that can milk a cow?

T HIS story crops up from time to time, generally when a farmer or dairy hand has seen a snake near the milk shed just before he discovers one of his cows dry. Having heard the story about snakes milking cows, he puts two and two together, and gets five. Snake was present, cow was found dry, therefore snake milked cow. To milk a cow dry, the snake would not only have to hang onto the cow with its teeth—an indignity that no self-respecting bovine would permit—but it would have to extract quarts of milk and retain the fluid while it

crawled away toward its hiding place like an inflated sausage balloon. Once I poured two ounces of milk down the throat of a snake. When I placed it on the ground, the milk ran out of its mouth, for the snake, although able to expand its body to accommodate the liquid, was unable to retain it. A cow-milking snake seen by a farmer is generally a king snake on the hunt for mice. Why, then, is the farmer's cow dry? I haven't the slightest idea. This is one of the most fantastic of all the yarns that have gathered

around the subject of snakes. Why people should pick on the reptiles as the heroes or villains of their tallest tales is a mystery, but it has been going on ever since Eve pulled the one about the talking serpent. Even hunters and woodsmen, who ought to know better, add to the list.

Do bull snakes always kill and eat rattlesnakes on sight?

T HE bull is not a snake eater either by inclination or by habit. Other snakes do not form a part of its diet. The king snake and some racers may devour other snakes under certain conditions, but bulls and rattlers are not naturally unfriendly. In January, 1937, I placed a red rattler, a Pacific rattler, and a bull snake in the same cage. They have grown up together, they still share the same quarters, and I've seen no sign of trouble to indicate enmity, jealousy, or murderous intent among any of them.



Rattlers do NOT anchor themselves with their tails

Do rattlesnakes anchor themselves before striking, by forcing their rattles down into the earth?

W ISH this one were true, even of only one or two individual specimens. I could reap a fortune with them in a side show. But unfortunately, the statement is pure legend, wholly without foundation. No man of science has ever seen and reported a rattler anchoring itself. Isn't it curious that peo-

ple actually believe so-called eyewitnesses who retail stories like this, or describe in detail a water moccasin or copperhead three feet longer than any ever reported by trained collectors?

Can some snakes crawl faster than a race horse can run?

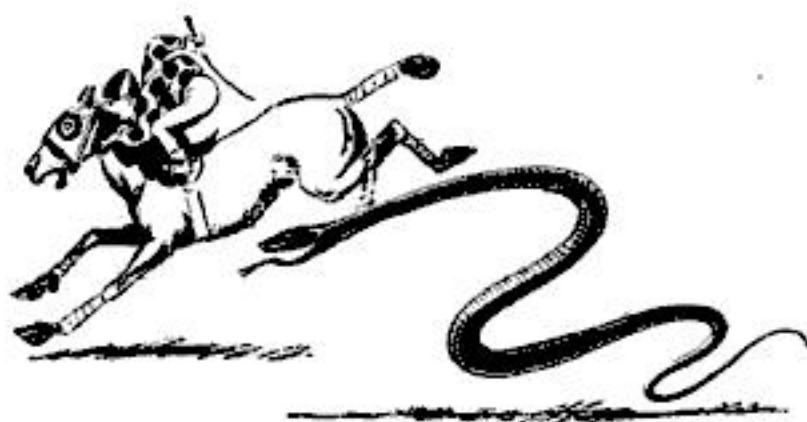
ON A collecting trip into Oklahoma several years ago, I spotted a snake known as a prairie coach whip, a racer that legend declares possesses the speed of a thoroughbred horse. It was lying near the top of a mud cliff, perhaps seventy feet away, and seemed to be watching my movements intently. As I turned and walked away, the snake followed me for about 100 feet. When I stopped, it stopped. When I turned and started toward it, the coach whip reversed itself and slithered away, and although its departure seemed swift, I gained on it easily until it disappeared into a hole. That snake followed me, I believe, not because of an aggressive spirit but merely out of curiosity, and his subsequent flight certainly broke no speed records. I don't know what his exact speed was, but I do know that time trials with electrical recording equipment have shown that racers have a top speed of about three and a half miles an hour. No, I seriously doubt that any snake could provide satisfactory competition for a Man o' War, a Seabiscuit, or even a junkman's plug.

Are there any snakes that have a poisonous breath?

WELL, not so long ago an aged farmer came upon a hognose snake, or spreading adder, near his corn crib. "That varmint stood on its tail and blew his breath in my face," he reported to me with the utmost sincerity. After this incident, the farmer said he had to take to his bed, where he stayed several days, cold sweats breaking out on his body each day at sundown. Now the hognose is a very interesting snake. It can flatten its head like a cobra, and to the



Even a reptile isn't low enough to use poison gas



Snakes offer no competition to a fast race horse

accompaniment of loud hisses, make lightning stabs at its adversary. If it fails with this bluff, it may turn on its back, mouth open and tongue hanging out, playing possum. Sometimes a hognose will remain inert in this position until its mouth fills with dust. Probably this particular hognose had been scared by the farmer's sudden approach, and undoubtedly it hissed and stabbed with a will. But the reptile certainly never stood up on its tail, and with equal certainty, I believe it was fear and nervous shock, not a "poisonous breath" that put the farmer between the sheets. Nothing I can tell him, however, will make him change his original version of the incident.

Is a snake in striking position when it is coiled?

WHEN a snake is coiled up it is either sleeping or resting. In a defensive striking position, part of its body is more or less coiled on the ground, but head and neck are raised, generally in an S loop. Incidentally, the distance that a snake can cover when striking is much less than is popularly believed. A rattlesnake can strike accurately only as far as it can straighten out the raised loop mentioned above, or approximately one third to one half of its total length. If you hear a snake rattle, stand perfectly still, for a rattler will seldom strike a motionless object.

Are all rattlers vicious?

BY NO means. The red diamond rattler often permits itself to be captured and put into a sack without even sounding its rattle. In captivity, it becomes quite tame.

Are there many deadly snakes that are extremely small?

NO. AMONG the supposed examples of tiny poisoners is the desert worm snake. In reality, this reptile is quite defenseless. Most deadly snakes are large.



Boy Collector's Many Hobbies Create Amateur Museum

HOBBIES seem to be the hobby of Conrad Auel, of Knoxville, Pa. For in addition to collecting stones, coins, leaves, feathers, fossils, antiques, and guns, he conducts experiments in chemistry and mineralogy, and spends clear evenings observing the stars through an eighty-year-old telescope that

belonged to his great-grandfather. The result of these diversified interests is that the third floor of the Auel home is a veritable natural-history museum. On shelves along one wall more than 600 curious stones are displayed, with specimens from every state and from a dozen foreign countries. Above a group of historic grave markers on another wall is a display of guns. A section is reserved for Indian relics, while a prized possession is a 150-year-old tooth extractor.



Conrad Auel in his private museum. Above, he offers to demonstrate a rare antique, a 150-year-old tooth puller

Truck Carries Fire-Fighting Exhibit

How dangerous gasoline, oil, and electrical fires can quickly be extinguished by smothering them with clouds of carbon dioxide gas is being shown with the aid of the

demonstration truck pictured below. Shot from the nozzle of a hose connected to storage cylinders within the truck, the "dry-ice" gas smothers the flames.



Demonstration crew smothering a fire with carbon dioxide gas from storage cylinders inside the truck

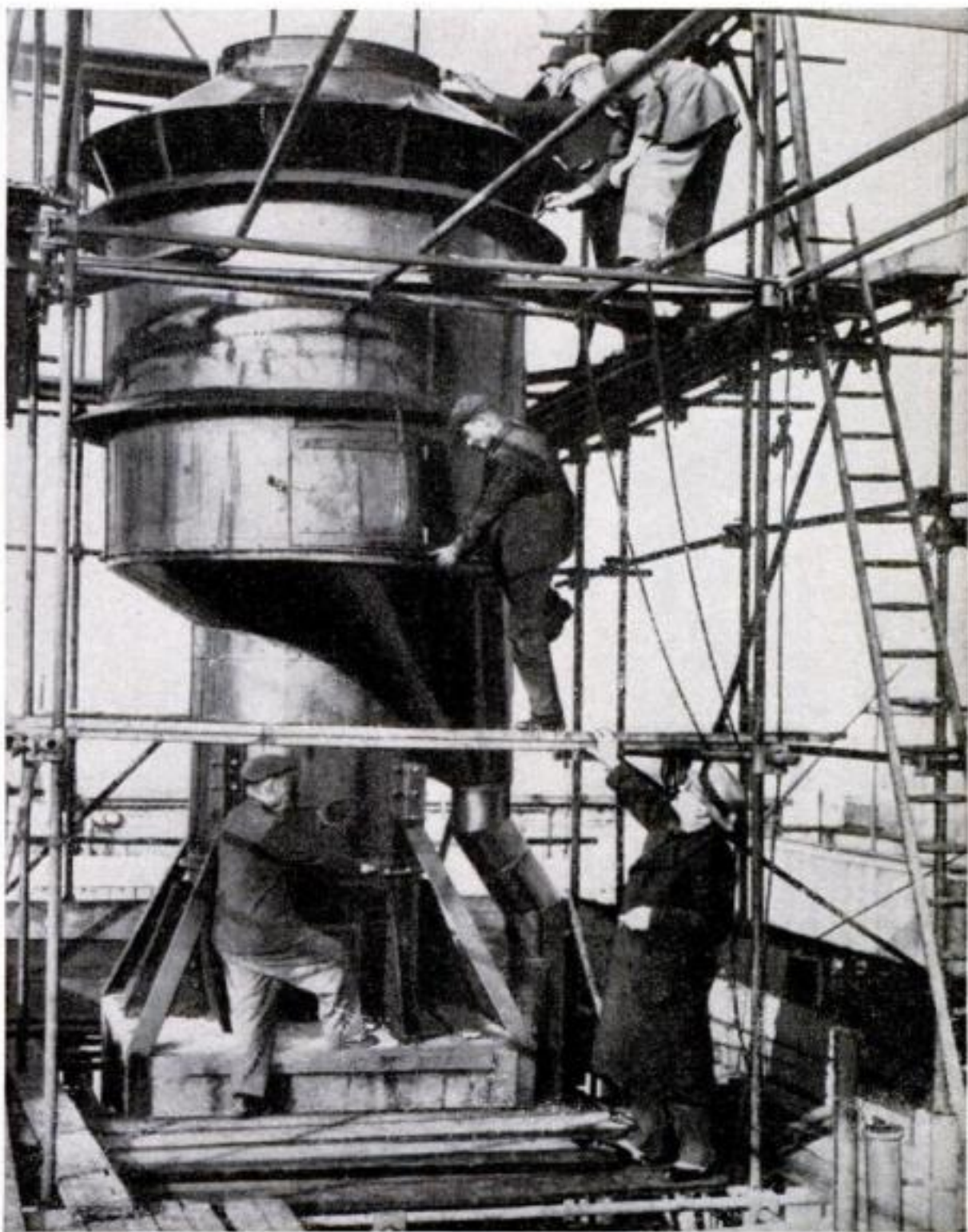


Steel Helmets To Get Visors of Chain Mail

VISORS made of heavy chain mail are being perfected for attachment to the helmets of British soldiers, as a means of protecting their eyes from shell fragments when advancing under enemy fire. As pictured above, the visor can be turned back when not needed. First used late in the World War, the visor is being improved by Sir Richard Cruise, eye specialist.

Soot Trap Launderers Smoke

ONLY light, clean smoke is said to issue from chimneys fitted with a soot collector designed by a French inventor, who claims that general use of his device in London would prevent the famous thick fogs caused by condensation of moisture on soot hovering over the British capital.



Soot traps like this may make the famous London fog a thing of the past



Installing a crystal. In the insert, note the surplus plastic

Watch Crystals Are Melted into Place

UNBREAKABLE watch crystals are melted into place by a novel process developed by Frank Dutcher, of New York City. A transparent plastic material which slightly magnifies the numerals on the watch face is heated to a temperature of 225 degrees F. and set in the rim under slight pressure, with the special apparatus pictured at the left. The result is a clear, smooth, and unbreakable crystal which cannot fall out.

Spray for Hair Gives Artificial Halo



Her hair glows in the dark. This striking effect is produced by a luminous lacquer sprayed on the coiffure as shown at left

LUMINOUS lacquer, sprayed on the hair after it has been arranged, imparts a firefly glow after dark to the latest coiffure devised for women by a New York beauty expert. Other striking effects are obtained by the use of flowers and feathers, treated with phosphorescent dyes, as hair ornaments for nighttime wear.



A quick tug on the chain releases a stream of water

Spring-Action Screw Driver Sets Tappets

TELESCOPING within its handle, against the pressure of a spring, the "jumping-jack" blade of a new screw driver makes it easy to adjust tappets on overhead valves while a car's motor is running. Although the blade follows the up-and-down motion of the tappet, the handle may be held perfectly steady.

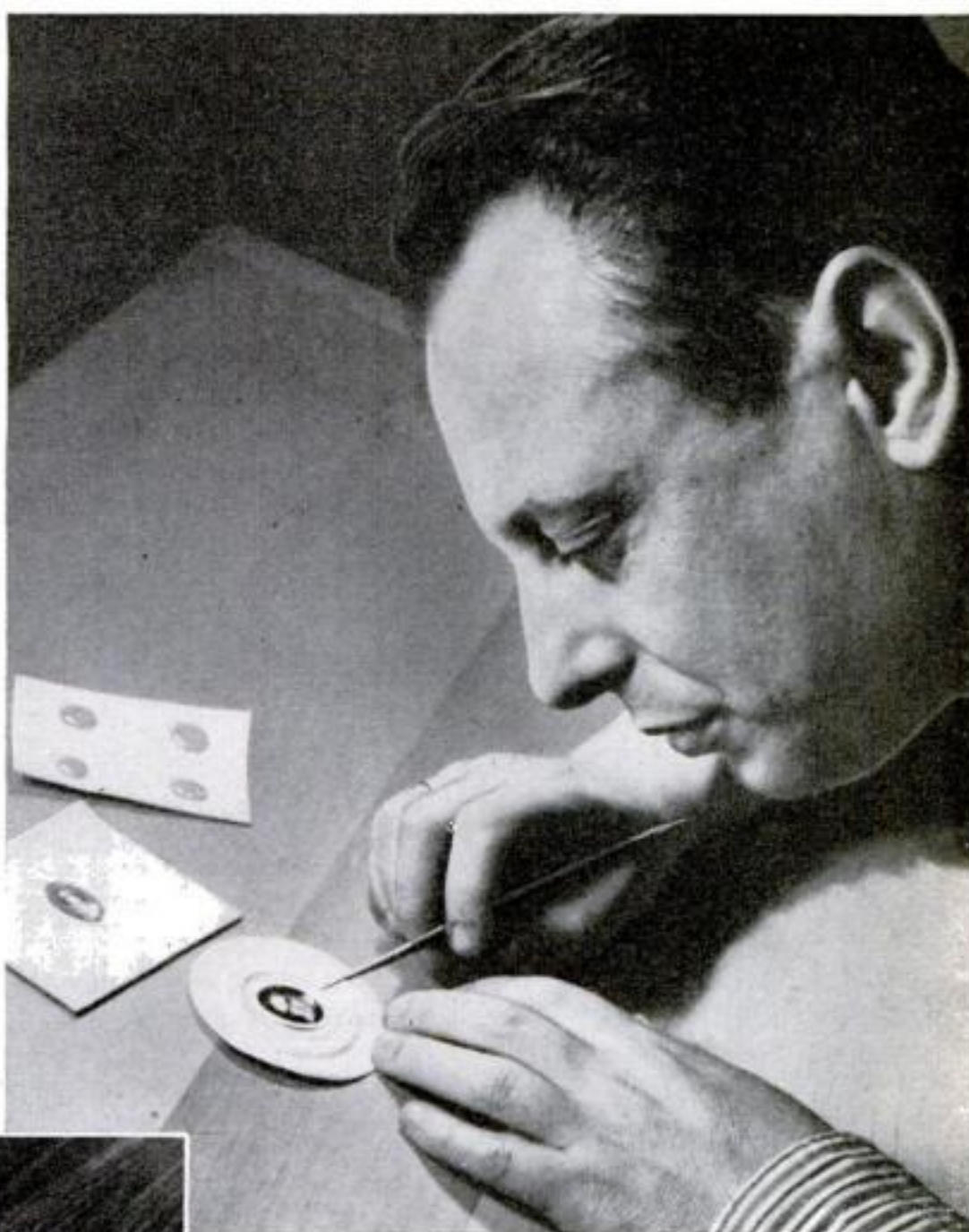


Emergency Shower Bath Puts Out Clothing Fires

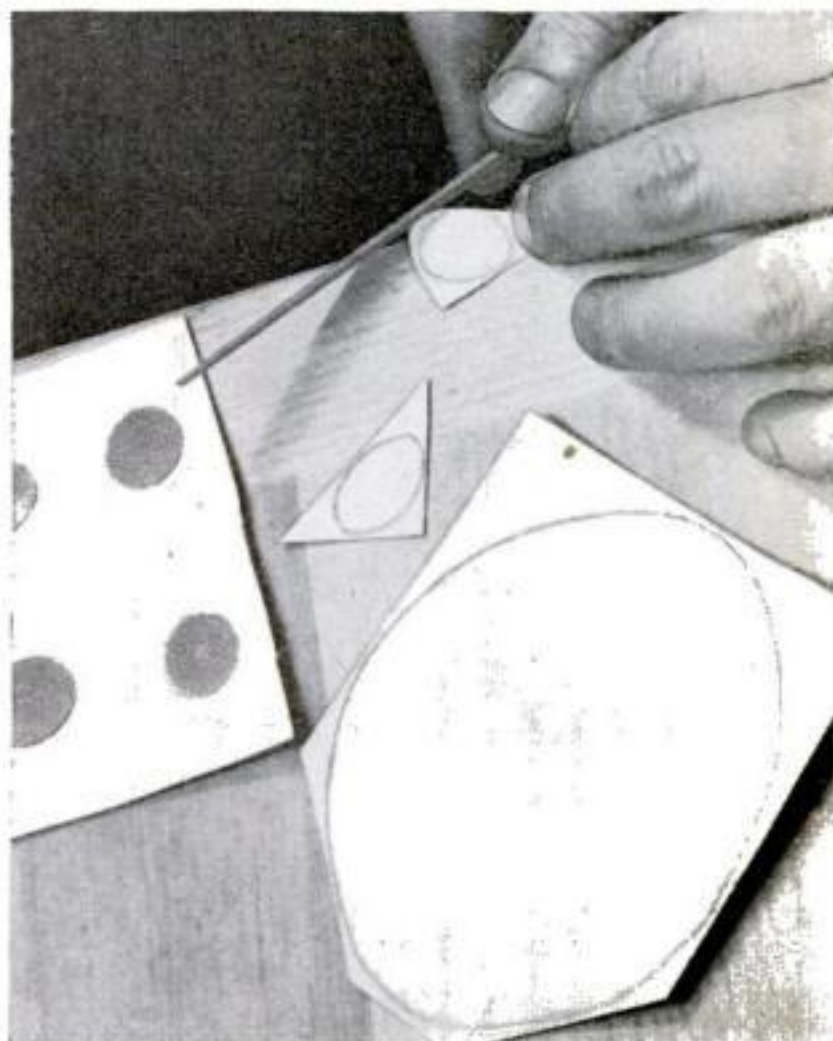
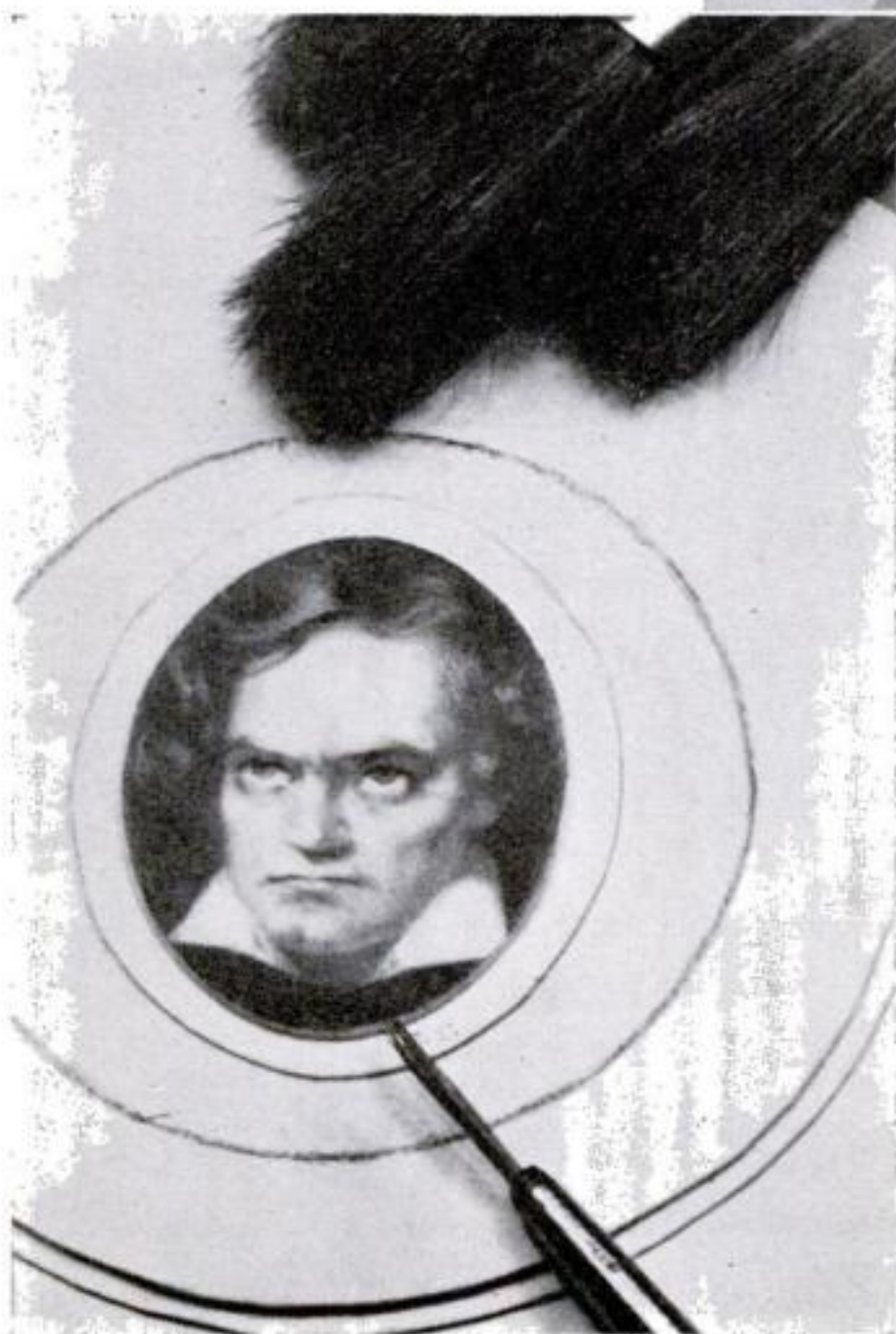
LABORATORY and industrial workers, exposed to the hazards of inflammable materials and dangerous chemicals, will benefit by an emergency shower of new design. A tug on a hanging chain releases a torrent of water from an oversize head, to extinguish burning clothing or wash off spilled acid, as shown in the view at left.

Artist Creates Miniature Miniatures

ARTISTIC and faithful portraits, only half an inch in width, are executed for use in locket and rings by Charles Caruana, of Long Island City, N. Y. Gifted with excellent eyes and steady hands, he works with extremely fine brushes on paper, porcelain, and ivory. Formerly a worker on miniature movie sets, he found ready customers for his first portraits among film folk, and turned his talent to what has become a highly profitable profession. First he draws an outline in pencil; or, if ivory is chosen, in a neutral tint with a brush finer than a pencil point. Then he builds up his colors until the desired effect is obtained, applying the finishing touches by stippling. For porcelain, a special preparatory treatment, which is his secret, precedes the art work. Paper-thin sheets of ivory, the most expensive medium, give the finest results.

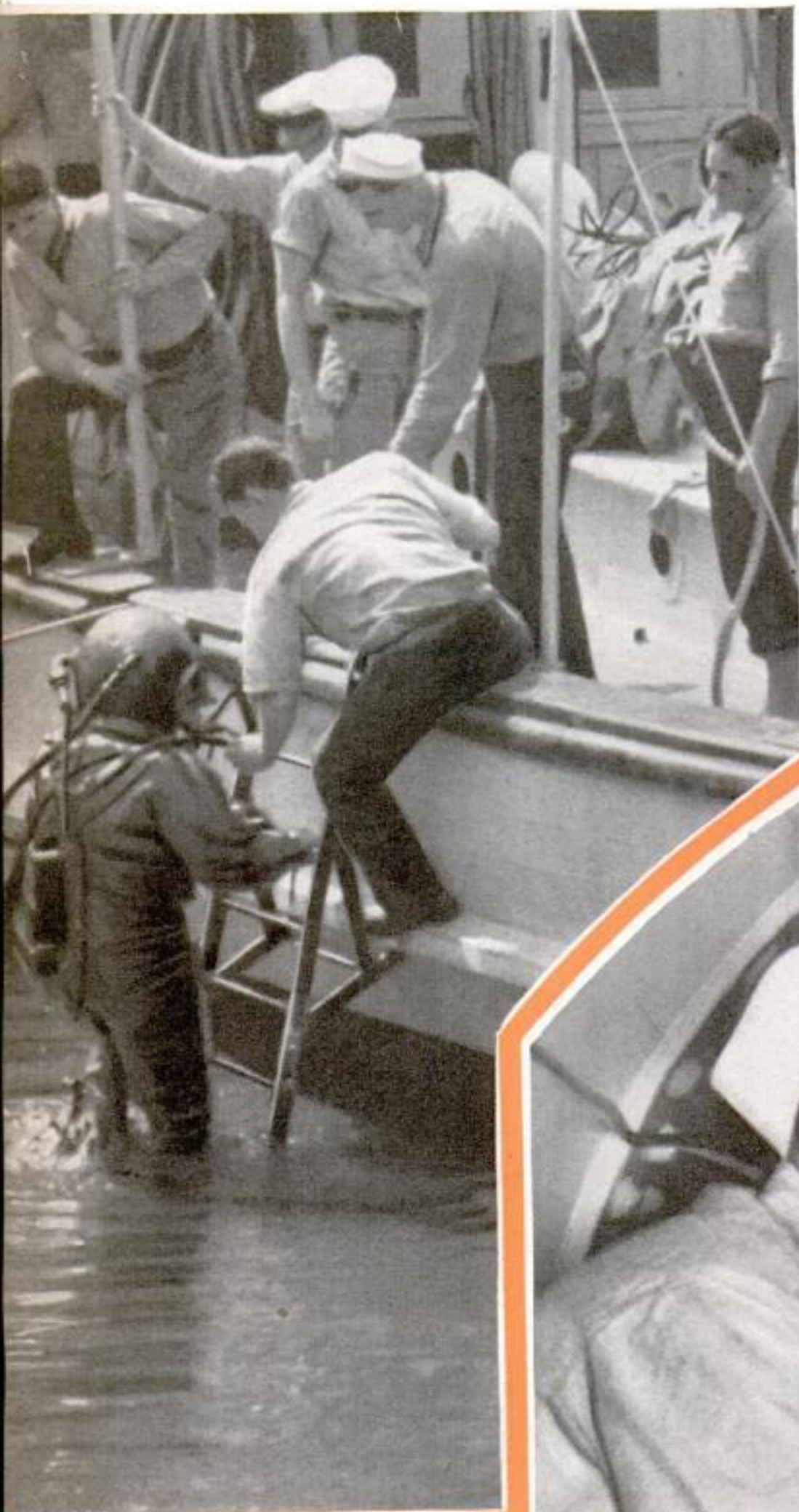


Charles Caruana at work on a delicate painting



Tiny ovals for the miniatures are cut from thin ivory sheets. Left, a miniature of Beethoven enlarged three times normal size to show its detail

How Our Navy Trains



A diver climbing aboard the U.S.S. Crilley, a vessel attached to the Navy's Deep-Sea Diving School at Washington, D. C., where men are trained for submarine-rescue work

In the recompression chamber at the right, recruits to the school are put under high pressure as a test of their fitness for the job

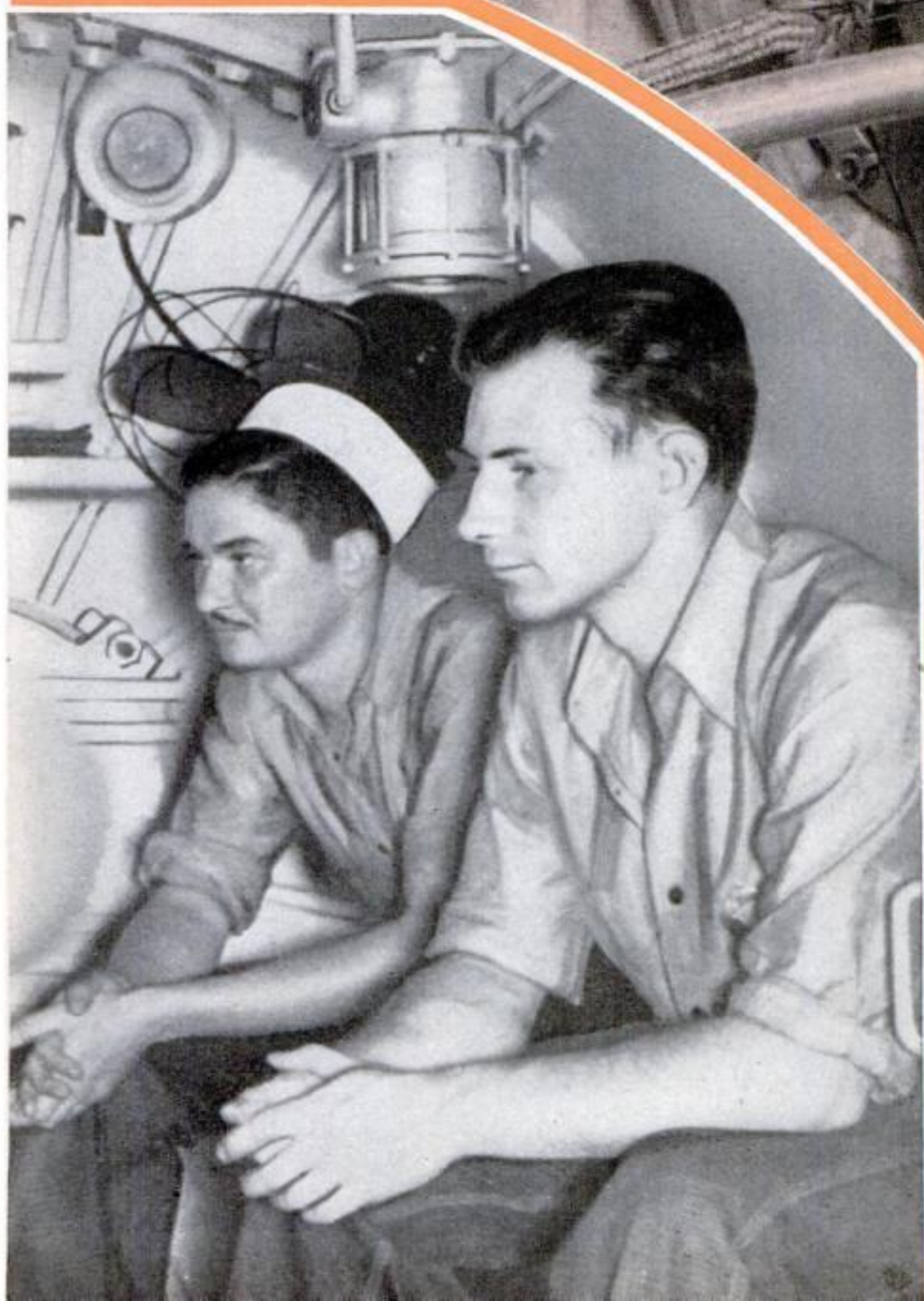
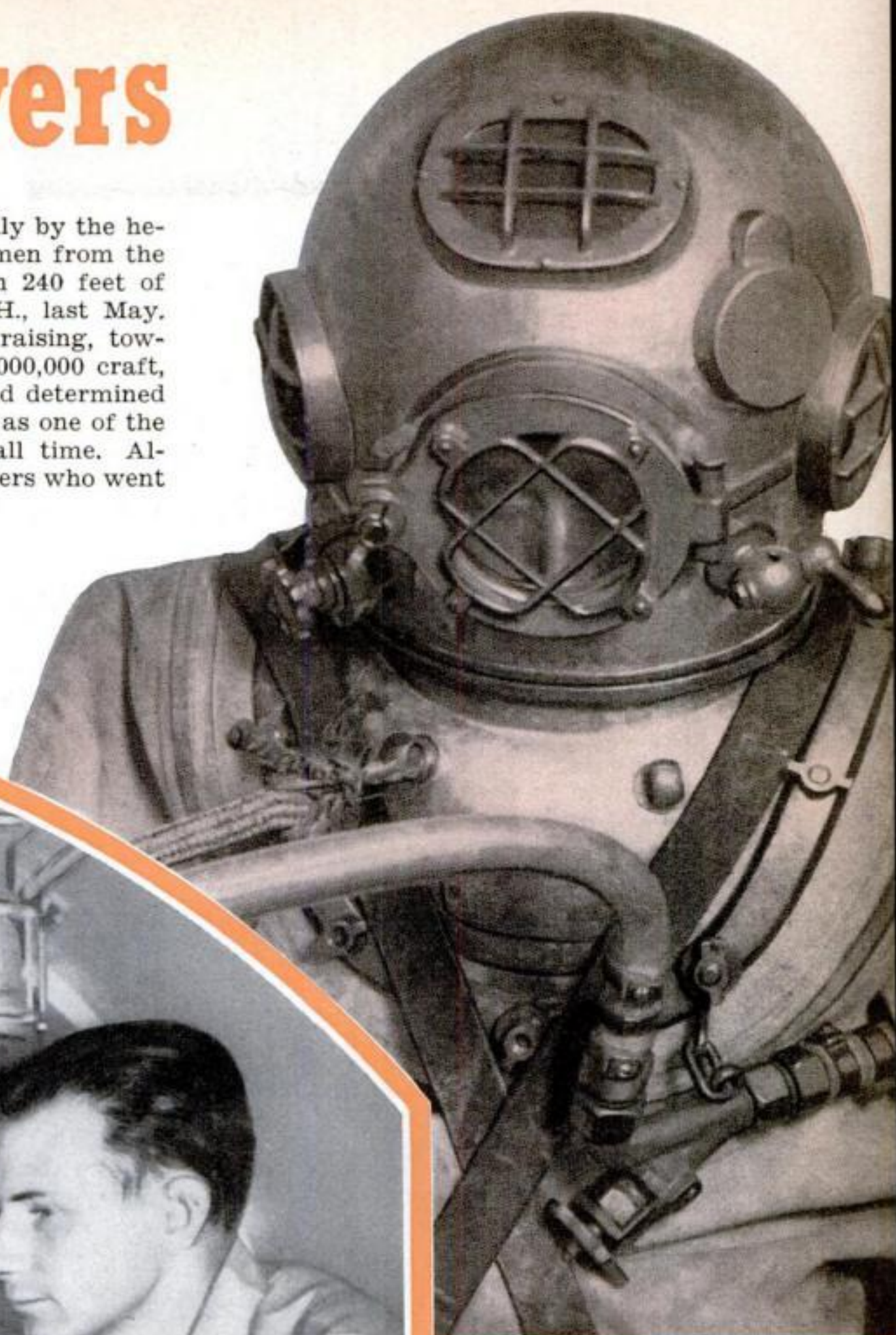
TRAINING men to save lives and property from the bottom of the sea, and to cheat death for themselves while doing it, is the thrilling job of one of the most remarkable schools of the United States Navy. Here, in this Deep-Sea Diving School, at the Washington, D. C., Navy Yard, officers and enlisted men are taught diving, salvage operations, first aid, underwater mechanics, and seamanship. After six months of intensive instruction, men who "make the grade" are sent out to fill vacancies on the vessels of the submarine-rescue fleet.

That they learn their lessons well,



Its Divers

was brought home powerfully by the heroic rescue of thirty-three men from the submarine *Squalus*, sunk in 240 feet of water off Portsmouth, N. H., last May. This, with the subsequent raising, towing, and docking of the \$4,000,000 craft, after 114 days of daring and determined effort, goes down in history as one of the greatest salvage feats of all time. Almost to a man, the sixty divers who went down under the icy waters to plug holes and fasten pipes and cables, and the officers who directed the operations, were trained in this amazing school to meet



AN UNUSUAL SCHOOL
TURNS OUT THE MEN
WHO START TO WORK
WHEN TROUBLE HITS
A U.S. SUBMARINE

By KENNETH M.
SWEZEY

the problems that historic rescue raised.

Before 1928, deep-sea divers of the Navy had been taught in makeshift groups aboard ships, and at land bases where equipment and experienced divers were available for personal instruction. Submarine-salvage technique had been only vaguely developed. The tragic sinking of the submarines *S-51*, in 1925, and *S-4*, in 1927, demanded a drastic new approach to the whole problem.

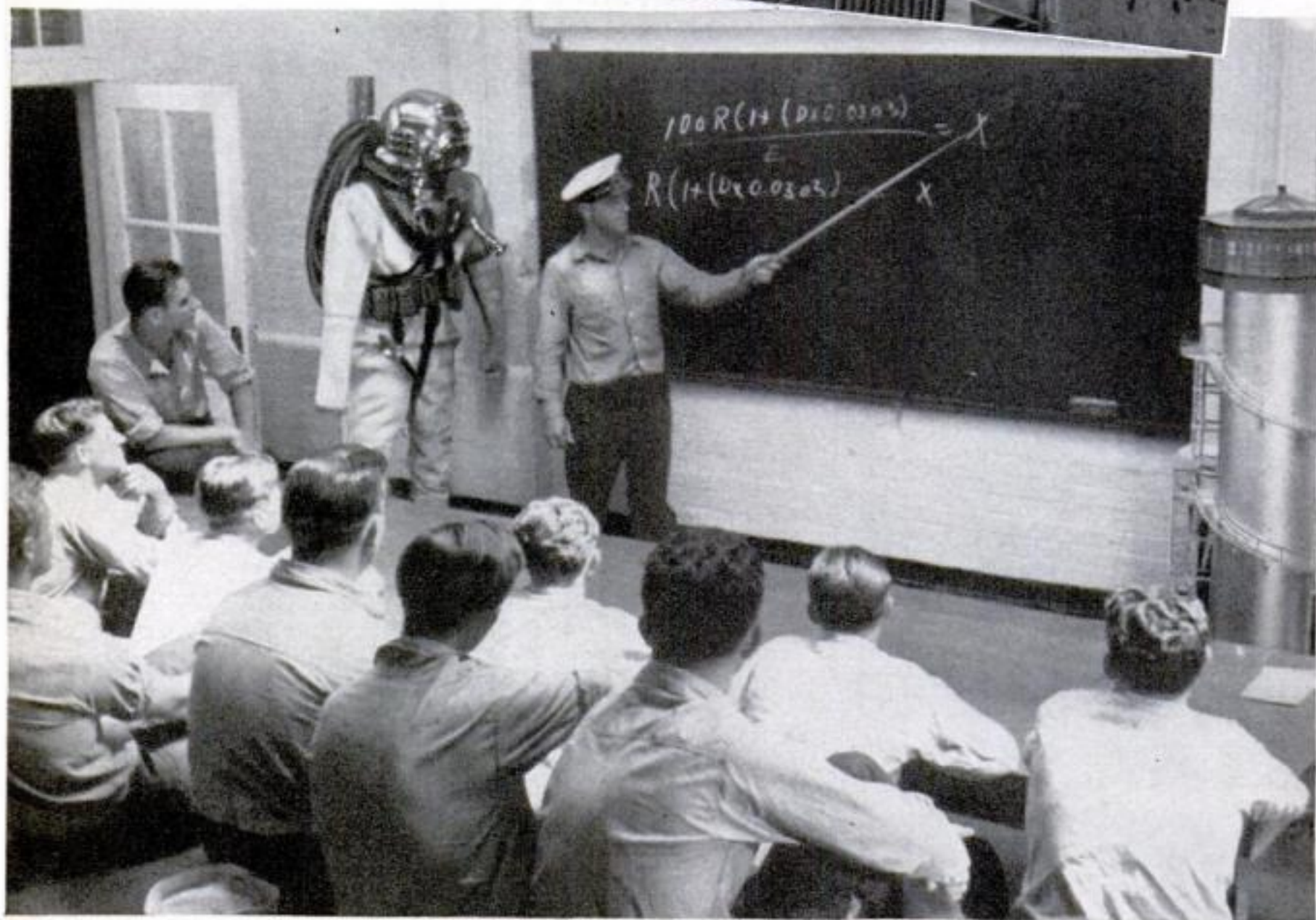
Better rescue devices had to be perfected; a powerful mine sweeper, converted and fully equipped as a rescue vessel, was assigned to each of the five major submarine units in the Atlantic and Pacific oceans. Then the present school for diving was founded, with a definite program worked out for training officers, crews, and divers to meet every possible underwater emergency.

Commissioned officers who attend the school study the deeper theories of hydrostat-

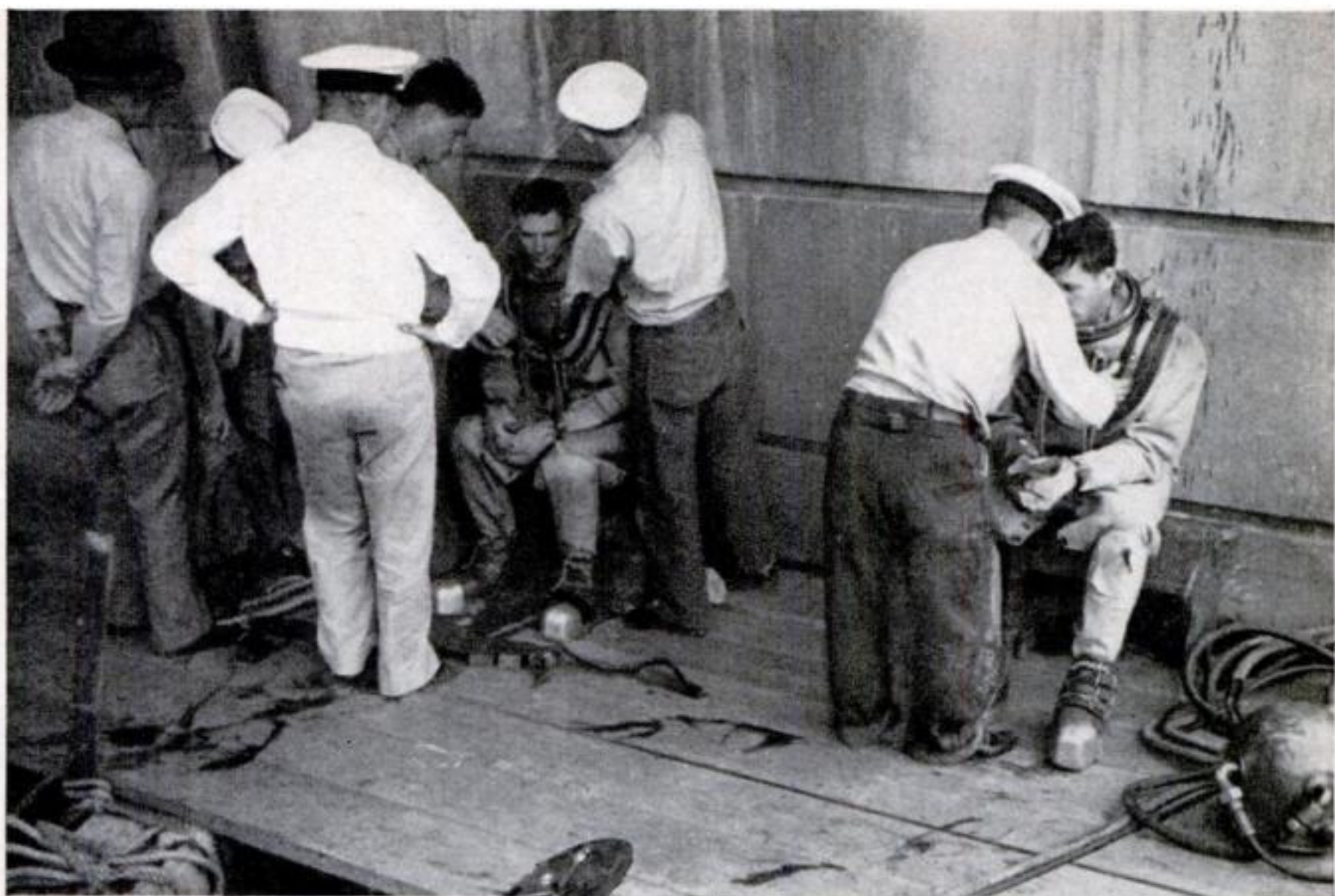
ics, rigging and flotation problems, and the theory and practice of diving. Medical officers, about to join submarine squads, first go to school to learn the diagnosis and treatment of ailments peculiar to the diver.

Recruits for the regular course of the diving school are chosen from volunteer petty officers of the Navy. They must be under

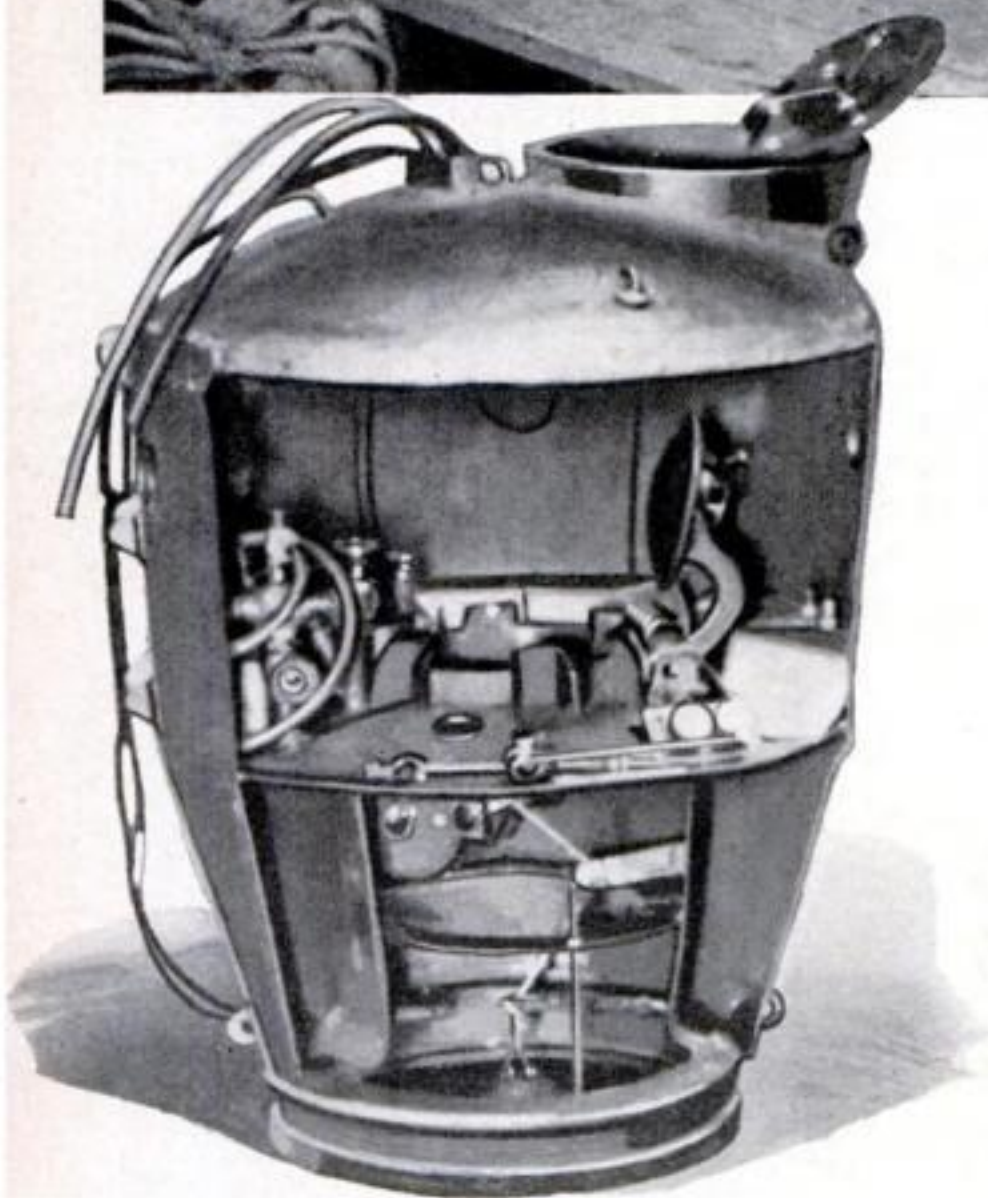
With a model in a tank, students are taught how to rig pontoons to a sunken submarine for raising it to the surface



A class in diving theory. At the left of the instructor stands "Jake," the standard Navy diving outfit



Dressing a diver for a trip under the water. Another, just out, is being relieved of gear



This is a model of the rescue chamber used in the rescue of the survivors from the Squalus

thirty, and pass a rigid physical examination. Good heart and lungs are absolutely necessary. Contrary to popular opinion, medium-size, wiry men often make better divers than big, he-man bruisers. Fleishy men are taboo, on the ground that fatty tissue seems to absorb more dangerous nitro-

gen bubbles, that cause the "bends," than does solid muscle.

Graduates of the diving school are certificated as divers, 1st class. To maintain this high classification, they must make at least four dives of more than 150 feet every six months. Because of the strenuousness of the work, they must quit diving at forty.

Before a man makes his first dive, he is put in a recompression chamber and the air pressure is built up to fifty pounds to the square inch. If he can stand this pressure without ill effect, his next experience is a drop into the diving tank.

This tank is a big cylinder of steel, containing about twelve feet of water, and having an air lock at the top through which the diver enters and emerges. Although the actual water level always remains the same, water pressures equaling those encountered down to 300 feet in the sea can be artificially produced by forcing compressed air on top of the water. At a simulated depth of 300 feet, this pressure reaches the amazing figure of 133 pounds to the square inch, or a total pressure of about 133 tons (about 2,000 square inches of surface) on the diver's whole body!

In his first lesson, a novice diver does well if he learns merely to walk, with a water pressure just a little above that on the surface. As his ex- (Continued on page 241)



Well-Bred Parrot Uses a Spoon

BOBBY, an African gray parrot, imitates the table manners as well as the conversation of his master, John Gillen, of New York City. Grasping a spoon in one claw, Bobby shovels mashed potatoes and strawberry shortcake into his beak in the best society manner. Between spoonfuls, he entertains with table talk.

Green-Light Lamp Shows Inner Eye

MINUTE examination of the inner eye is made possible by a new mercury-vapor lamp that emits only green light. Developed by Dr. H. Rommel Hildreth of Washington University, St. Louis, Mo., and perfected by Bausch and Lomb optical experts, the lamp sends a penetrating beam of green light through a patient's eye pupil, cornea, lens, and retina, making blood vessels and nerve fibers as clear as printed letters on a page to the examining physician.



Examining the inner eye with the aid of the new green-light lamp

Hobbies Appear on New Coats of Arms

MODERN coats of arms, incorporating the hobbies, nicknames, and favorite expressions of their owners, are a novelty recently introduced. The shield pictured below, made for a man named Reed, shows that he likes fishing, golf, hunting, sailing, skiing, is nicknamed "Scoops," and often uses the slang word "gosh."



Modern coat of arms includes owner's hobbies, nickname, and favorite word

Can Do!

By **BERTON BRALEY**

In the land of Cathay there's a phrase that they say
When a difficult job is in view;
Just a Chinese refrain that is simple and plain:
"Can do!"

"Can do!"
A promise and prophecy too,
The slogan of workers all over the chart
Who go on and finish the jobs that they start;
Two words—but the spirit of men who "come through"—
"Can do!"

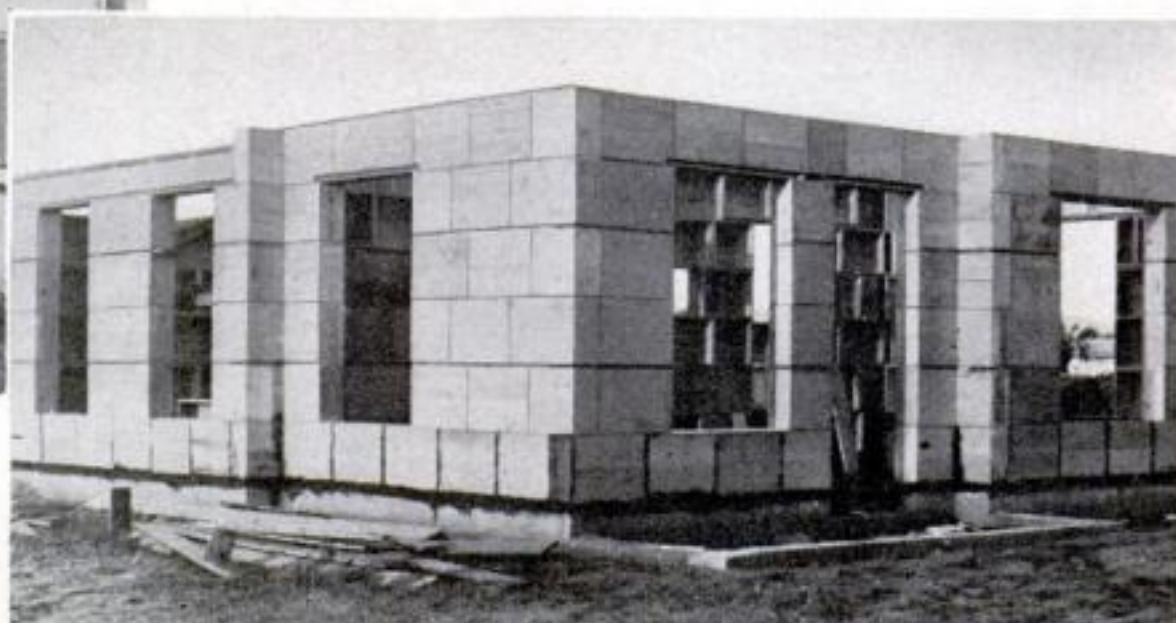
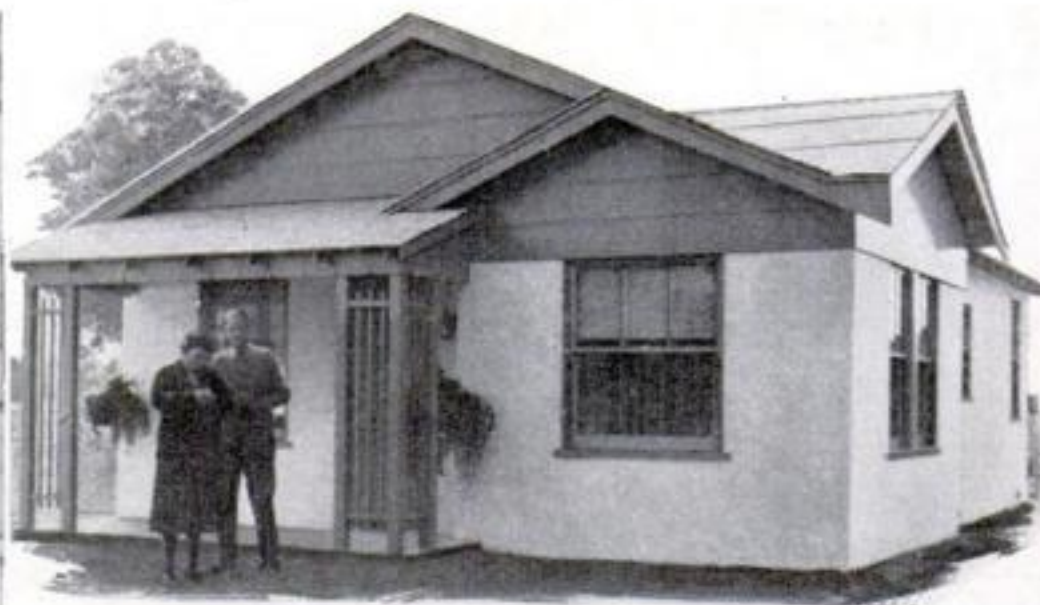
Two words said in "pidgin," but they're the religion
Of those indispensable few
Whom naught can defeat as they blithely repeat
"Can do!"

"Can do!"
It makes the incredible true;
It works the unworkable, moves the immutable,
Unearths the hidden, unscrews the inscrutable,
Does all the jobs it's impossible to!
The world's rolled along by the laddie-bucks who
"Can do!"

Houses Built of Grape-Picking Boxes



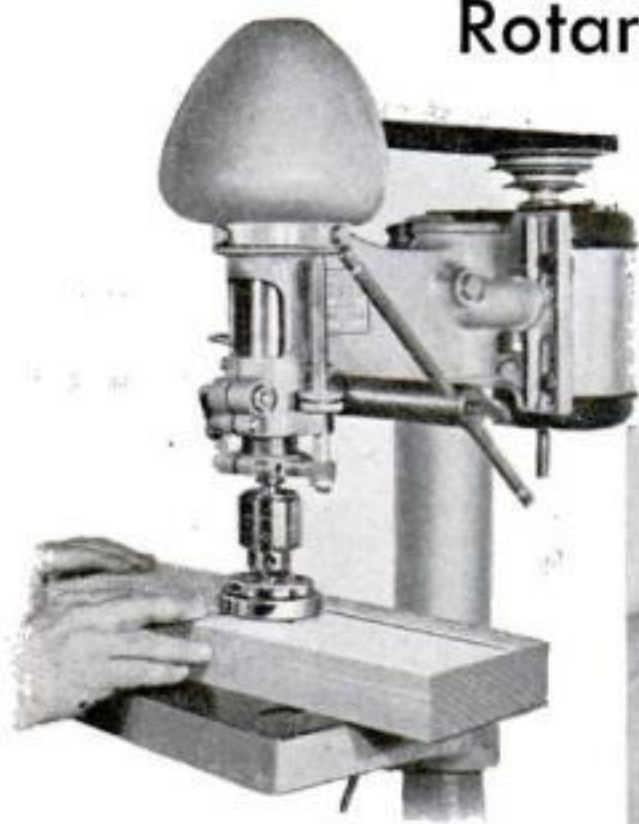
How boxes are fitted together to form the walls of a house. At the right is a home under construction and, above it, a completed home



FOR the construction of walls and roof, sturdy, insulated homes erected recently in Porterville, Calif., employ boxes of the type used by grape pickers. Set on their sides and sealed at the joints, the grape-picking boxes provide dead-air space in the

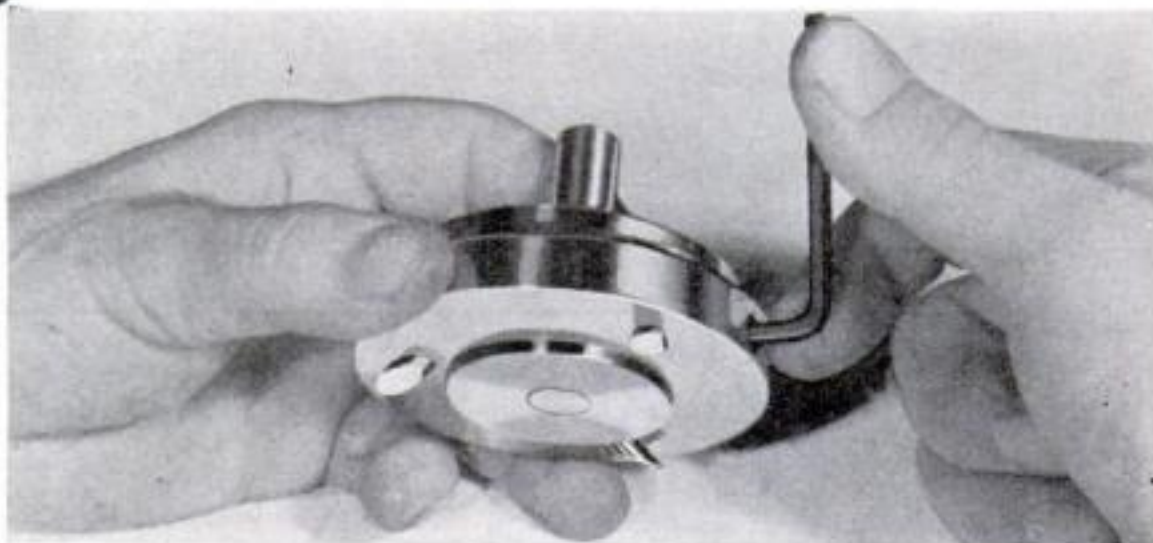
walls for insulation against outside heat. To determine the strength of the boxes and their suitability as a construction material, tests were made with a compression machine. The results showed that each box would support a load of about ten tons.

Rotary Wood Planer Fits on Drill Press



The wood planer in use on a drill press. Close-up at right shows its three steel cutting knives

WHEN used with a drill press, a novel tool can serve as a wood planer, surfacer, and finisher. Three steel cutting knives are set into a circular head which fits into the chuck of the drill press. No sanding is required with this tool, the manufacturers claim, as it planes to an accuracy of two one-thousandths of an inch.





A two-level bridge crossing on the "Metropolitan Southern." Below, a member of the Washington club making a model house



Scale model of a B. & O. "President" class locomotive. Right, a small engine on the turntable



Fans Run Big Model-Railway System

MORE than sixty business and professional men contribute to the planning, construction, and operation of an elaborate model-railroad system installed in special rooms in the Union Station at Washington, D. C. The layout comprises 160 feet of 1½-inch-gauge main-line track running through elaborate

scenery made of a plaster compound laid on a wire-netting base. Pieces of dyed sponge simulate shrubbery, while rippled glass painted blue on its underside serves as water. Scale-model locomotives in service include the B. & O.'s "George Emerson" and the Pennsylvania's electric "GG-1."



A Pennsylvania GG-1 electric locomotive hauling a freight train through the realistic yards of the system

Chart Helps Women Pick Ties for Men

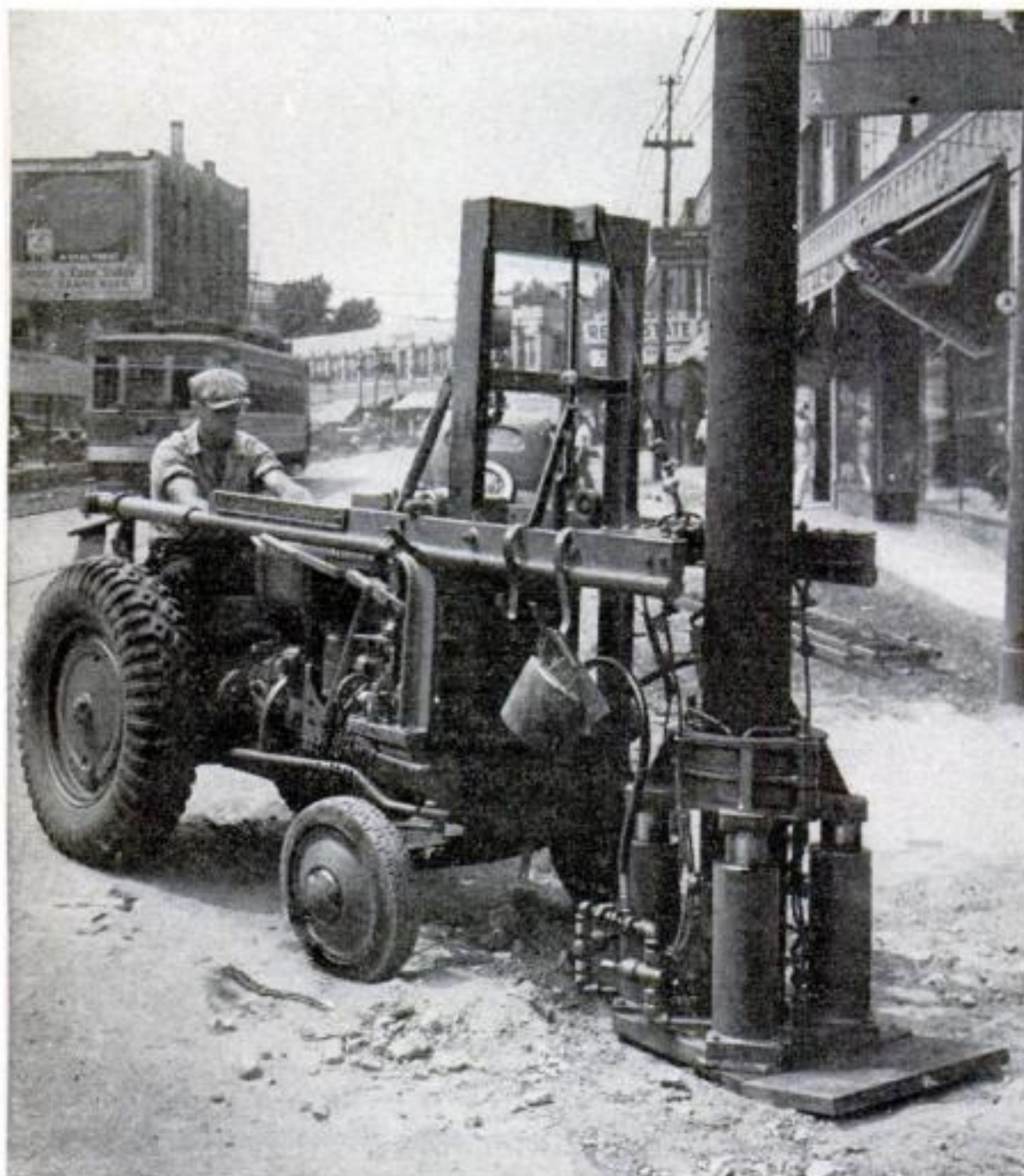
DISCREETLY neutral as to whether women should pick out men's neckties at all, a New York department store does the best it can by providing them with an ingenious shopping aid. A display card exhibits colored drawings of men with gray, blond, black, brown, and red hair. A necktie may be attached to a collar clasp on each drawing. By selecting a tie from an assortment below, and placing it on the proper clip, a customer may decide whether it is becoming to a given type of wearer—or, at least, whether she thinks so.



Neckties are attached to clips on the chart for appraisal

Jacks Pull Poles Out of Concrete

How to loosen steel poles embedded in six feet of solid concrete was a problem recently solved for a Chicago traction company by a specially equipped tractor. A built-in pump builds up pressure in four hydraulic jacks, bearing on a collar clamped to the pole to be removed, until the bond between the pole and pavement breaks.



Yanking a pole out of the pavement with the aid of a special tractor



Comb, Brush, Curler in One Handy Unit

COMB, brush, and hair curler are combined in a three-in-one accessory for women. Bristles of nylon, the new synthetic fiber made from coal, air, and water, flank the sides of the comb. The handle, which serves also as a curler, folds into a groove in the top as shown above, and the handy aid fits in a transparent plastic case.

Soviet Parachute Attack Gets Real Wartime Test

TRIED out a number of times in practice maneuvers, the parachuting of armed troops from transport planes was carried out under actual war conditions when Russian infantrymen bailed out behind enemy lines to aid in an assault on a heavily fortified position.



G-MEN

GUARD

FROM a dark side street, the two inspectors watched the caravan of ancient touring cars and sedans pull out of the big garage. They tailed the procession to the edge of the city. When it was plain that the gang was headed for the coast, the officers speeded ahead to the Jacumba, Calif., checking station, where they waited.

Twenty minutes later, the first of the cars came in sight and the flash lights of the officers signaled it over to the side of the road.

"What's the matter?" whined the driver. "I'm just going to visit my

By
**ARTHUR A.
STUART**



One of the border quarantine stations that protect the California cantaloupe industry. Right, inspector checking a load of melons



NATION'S MELON SUPPLY

brother. Look at my outfit."

He jerked a thumb toward an army cot and a couple of suitcases piled across the canvas-covered rear compartment. But the inspector lifted the edge of the canvas and sniffed a ripe aroma.

"Bootlegging melons, eh? Well, mister, if your brother wants to see you, he'll have to look you up in our county jail!"

Within ten minutes the inspectors had the whole caravan lined up along the roadside and every member of the Imperial Valley's biggest ring of melon bootleggers was in custody. Their racket was to get truckloads of condemned melons from the packing sheds for "hog food," reload them into passenger cars, and then run the inspection blockade which halts every truck leaving the valley. This time, a secret tip had put inspectors on their trail and led to their capture.

From early May to mid-September, the men who guard the nation's melon crop are busy supervising the picking, grading, and

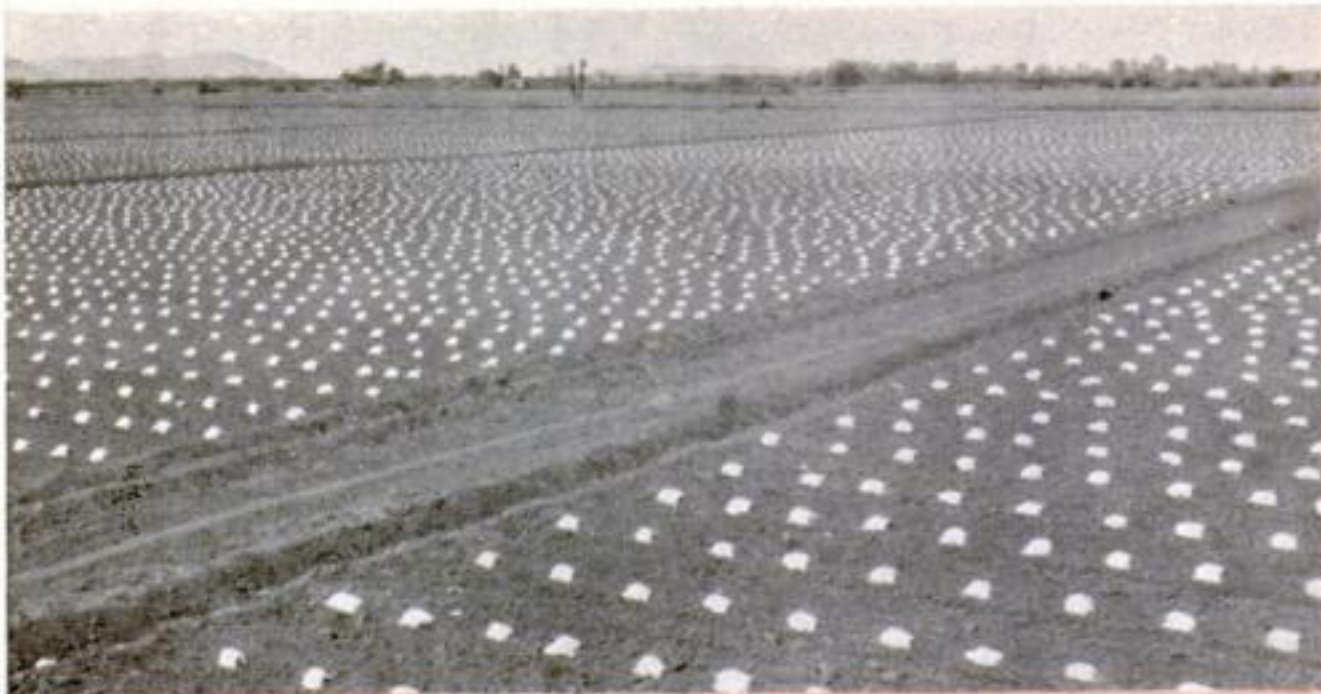


A passenger car loaded with "bootleg" melons caught by inspectors

packing of the 400,000,000 cantaloupes that American families will eat during the season. They run laboratory tests for sugar content, confiscate inferior melons, and crack down on bootleggers who seek to smuggle "hot" melons into retail channels. Their work makes possible an amazing multimillion-dollar "deal" in which whole trainloads of melons are purchased, sight



Picking cantaloupes in the Imperial Valley of California, which produces much of our melon supply



Air-conditioned fields: miniature hothouses of paper speed growth of vines

Below, placing a tent of waxed paper to guard young melons



unseen, by men who lay down spot cash for them clear across the continent, before ever a crate of cantaloupes begins to roll on its way!

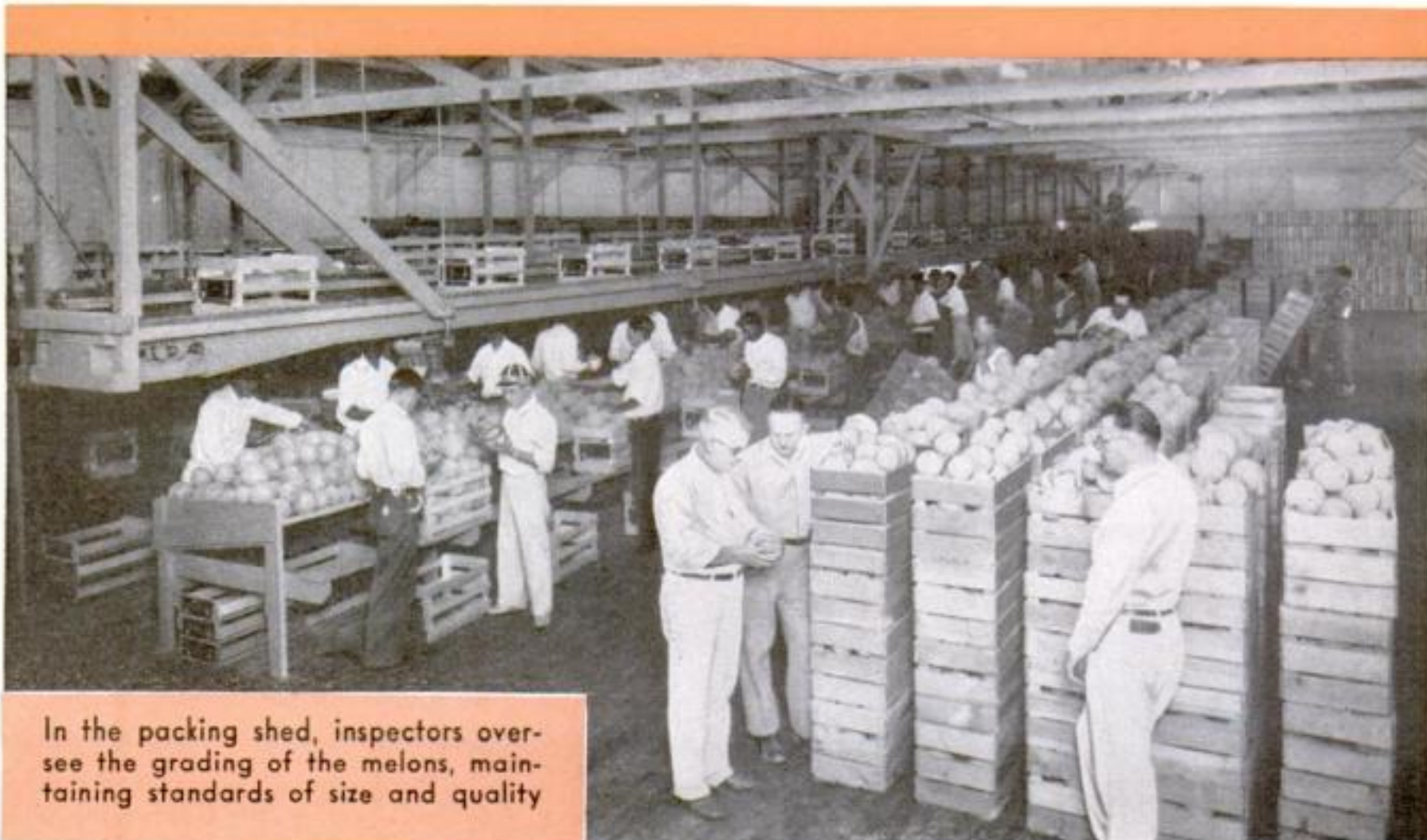
From seed to the fully ripened, golden-meated melon on your table now is a rapid-fire agricultural process speeded up at a hundred points by mechanical and laboratory developments. In Imperial Valley, a rich, ancient sea bottom 200 feet below sea level, scientific farmers get double crops by beating the seasons and turn melons out by the million, as uniform as automobiles from the factory production line.

The 1940 streamline cantaloupe comes from "air-conditioned" fields planted in November by machines which rapidly spray seeds thickly along the south side of each

long row. Behind follow men who stoop every three feet to push down a wire staple like a

croquet wicket, then deftly fold a square of glassine paper until it makes a neat tepee.

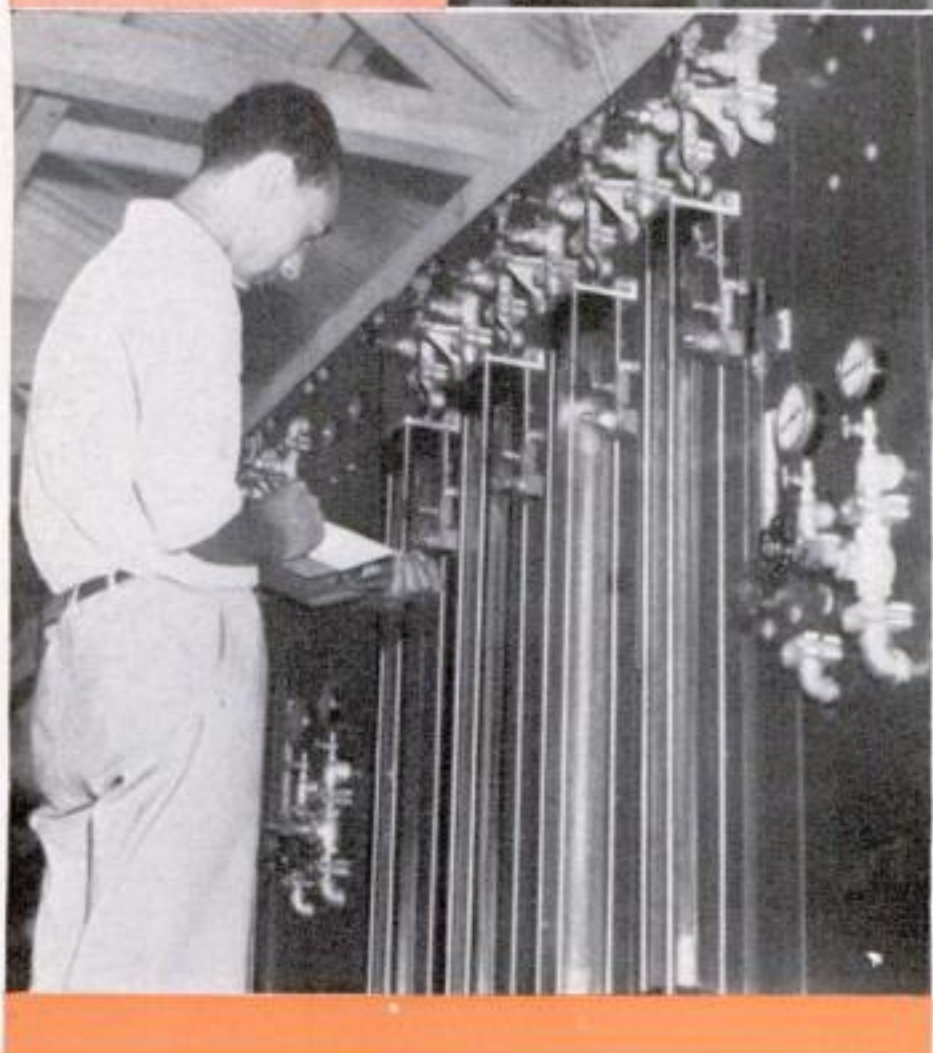
When the tiny plants push through the soil, thinners hoe out all but two plants to each hill, then replace the little tents, to shut out the chill northwest frosts, leaving the east end open to admit the morning sun. Water is measured out at intervals from irrigation ditches so that each row is kept moist just above the seed line. In March, the tents are removed. Six weeks later begins a feverish day-and-night drive that stops only when the last melon has rolled



In the packing shed, inspectors oversee the grading of the melons, maintaining standards of size and quality

Connecting a hose to the hatch of a refrigerator car to kill fungi on the melons by gas

Controls on this panel regulate the "fumigation" of a carload of melons



off the busy production line for shipment.

At daylight the pickers are in the fields, each carrying a strong canvas bag with a trapdoor at the bottom. As fast as the field boxes are filled, trucks rush them to the big, open packing sheds where graders inspect the melons as they pass along conveyor belts; discard damaged or substandard fruit; grade the others according to size, and send them on to a scrubbing machine, which sterilizes and waxes the melons against decay.

Now the conveyor belt carries them on to the packers, who work with almost incredible speed. One hand grabs a melon from the conveyor belt while the other snatches a square of colored tissue paper; one rapid twirl wraps the melon neatly and it goes into the crate. Farther down the line, a power press gently but surely compresses the boxful, forcing the contents tightly down. Automatic hammers instantly

nail fast the bulging slats on the boxes.

Meanwhile, freight cars wait on the siding where huge "precooling" fans are sending chill air currents through them. Overhead, conveyor belts bring up an endless stream of 300-pound ice cakes, which are mechanically shattered and the cracked ice shoveled down through the roof hatches into bunkers at each end. The crates of melons are stacked to shoulder height, with cleats between layers and plenty of room above for air to circulate. In some sheds, doors and hatches are closed and hoses attached to a machine that pumps in a gaseous mixture known as nitrogen trichloride, which kills fungi but does not harm the melons.

Within a few hours, the cars have chilled to the shipping temperature of forty-five degrees. The big circulating fans are removed, the ice bunkers refilled to the brim, the cars sealed and started on their way.

Through the night the trains roll endlessly out of Imperial Valley, sometimes pulling as many as 600 cars of melons daily. A single day's work would fill a train of box cars seven and a half miles long.

Out of this valley, only sixty miles long by twenty wide, last year went 10,800 cars of cantaloupes and honeydew melons—enough to lay down a continuous line of melons, three deep, from coast to coast. When you next dip your spoon into the golden meat of a cantaloupe, it's a fifty-fifty chance that it will be from these air-conditioned fields far below sea level at the bottom of the United States.



Vulcanizing the hem of a novel dress made for a "rubber ball"

Handy Starters for Loosening "Frozen" Nuts

NUTS that are hard to loosen, or difficult to reach with a wrench, are easily started with the aid of the accessories pictured below. Made to fit around nuts from three eighths to a quarter inch in size, the starters have a ribbed inside surface and a shoulder on the outside against which a punch is placed and hit with a hammer to loosen the nut.



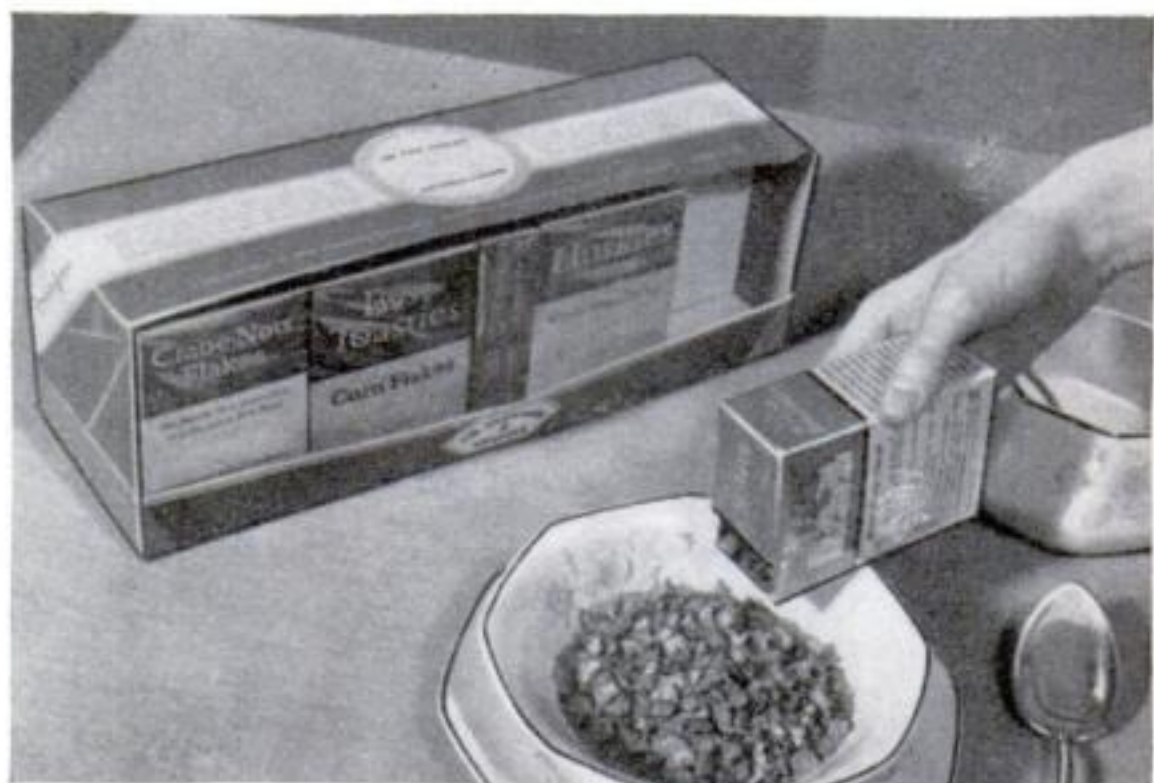
Placed over a nut, the starter is struck with punch and hammer

Rubber Gown Is Blow-Out Attire

A CURIOUS evening gown, made entirely of rubber, was one of the outstanding costumes worn at a costume ball held not long ago in Akron, Ohio, a center of the rubber-manufacturing industry. Above, the wearer of the gown is pictured having the hem of her unusual dress vulcanized.

Cereal Package Has Five Kinds

TO INSURE freshness and provide variety in breakfast cereals, one food corporation is now packing five different kinds of dry cereal in one carton. Inclosed within a transparent, moistureproof wrapper, the carton contains ten small-size packages of cereal, each holding one individual serving. Two small packages of each kind of cereal are included. Thus, a fresh package is opened whenever cereal is desired.



The large carton contains ten servings of five different cereals

Navy Flyers Learn How To Shed 'Chutes



FOR teaching Navy pilots how to get out of their parachutes when making emergency jumps into water, officers at the U. S. Naval Reserve base at Floyd Bennett Field, N. Y., have rigged up a parachute swing a few feet above the ground. The student first grasps the straps of the harness and pulls himself up into the seat so that the leg straps can be unsnapped. The chest straps are next unsnapped and the "jumper" throws his arms above his head to slip free from the harness. If a pilot descends with the parachute attached in a "water jump" he is likely to become entangled in the lines and drown.

Naval aviator practices getting out of parachute. (1) Lifting body to loosen leg straps. (2) Unsnapping chest straps. (3) Raising arms to slip free

Civilian Designs Simple Gas Mask



While fingers hold the nose, air is sucked through the bag

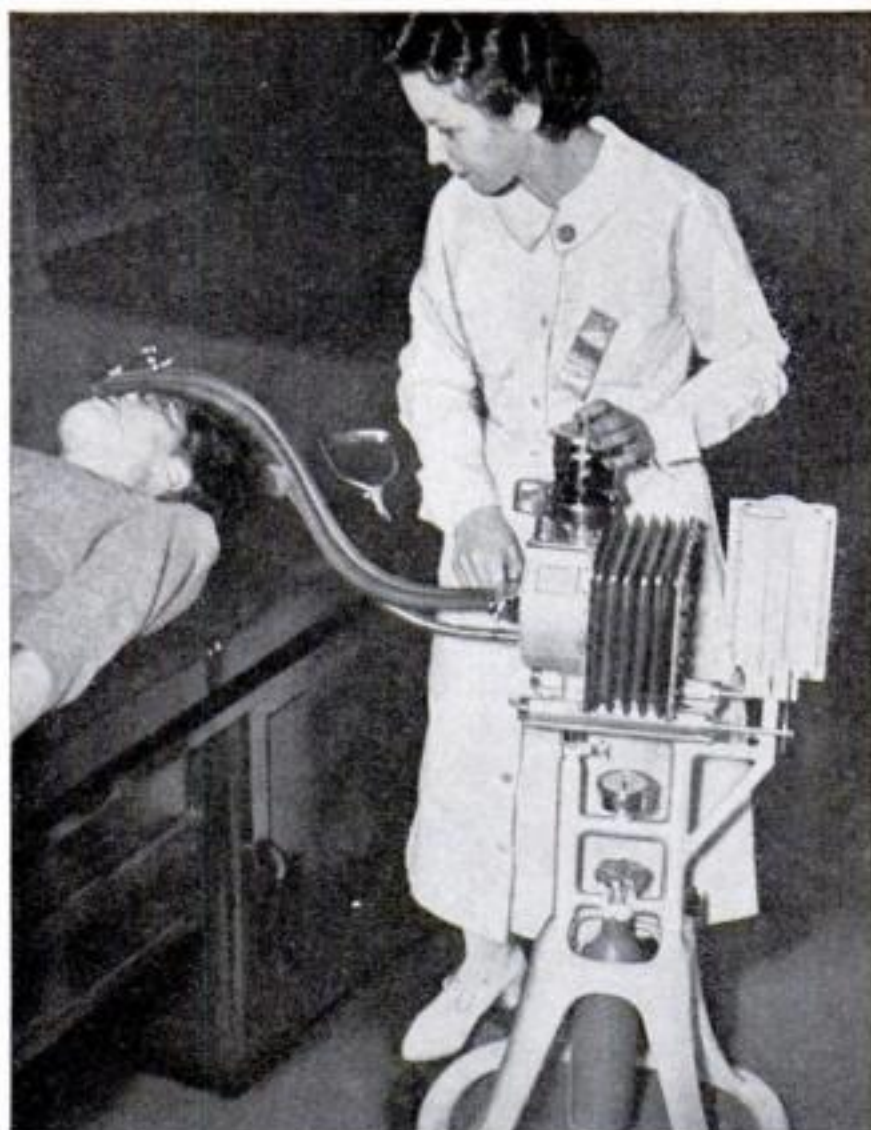
WITH the threat of gas raids hanging over more and more cities in Europe, the demand for gas masks in many communities far exceeds the supply. To provide some sort of gas protection in case of an emergency, an ingenious Scandinavian inventor has designed the improvised mask shown at the left. It consists simply of a hollow wooden tube and a cloth bag filled with chemicals. Air purified by the chemicals is sucked into the mouth through the tube, while the nose is held shut with the thumb and forefinger of the hand holding the mask.

Business Man Whittles To Soothe His Nerves

TO FREE his mind of business cares, outside of office hours, a Defiance, Ohio, executive took up the spare-time hobby of whittling. Products of his handicraft now form a remarkable and valued collection, including carved busts, wooden chains, and intricate geometrical figures chosen for their difficulty of execution. The picture below shows him fashioning a chain. Each chain is whittled from a single piece of wood.



This executive found whittling a good nerve tonic

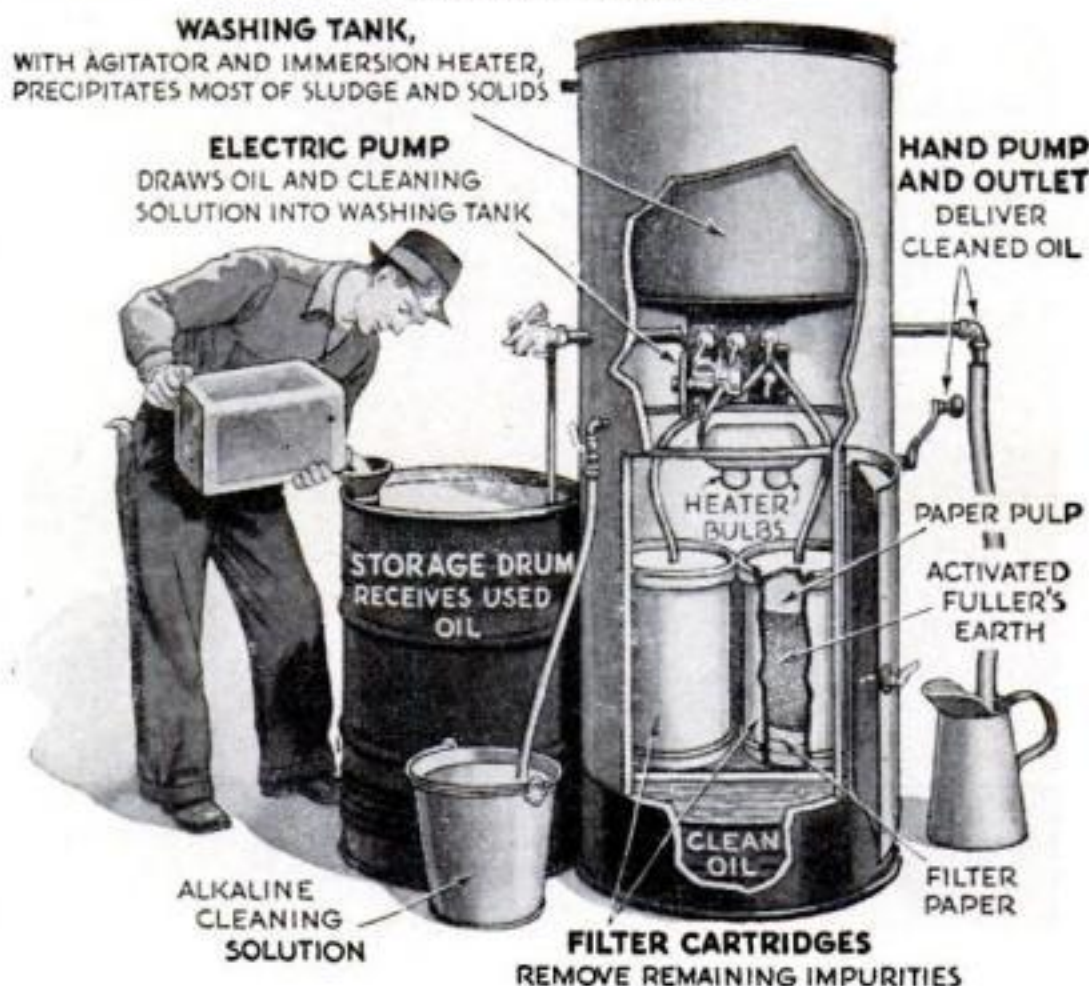


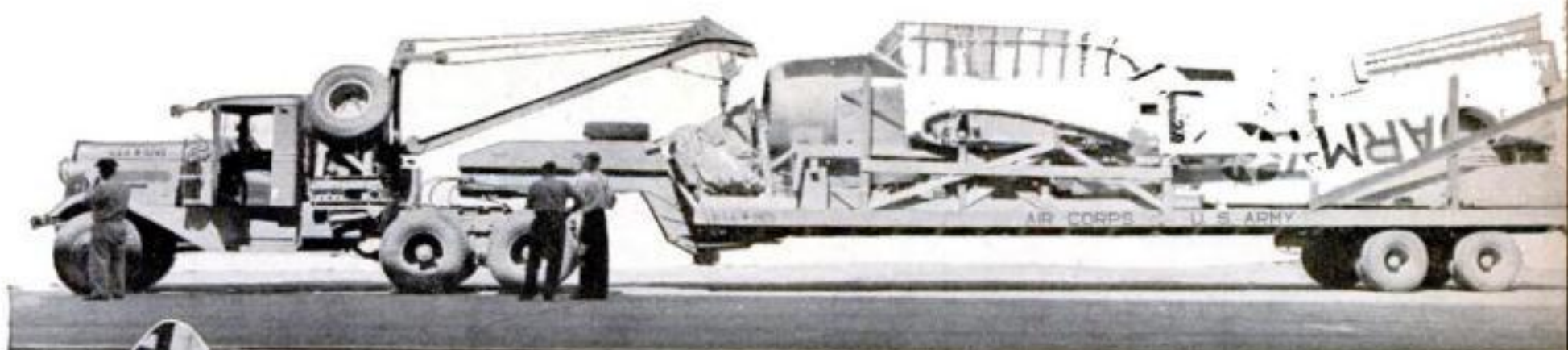
New Device for Doctors Makes Laboratory Test

A PORTABLE machine for use in a doctor's office, shown above, now spares patients a trip to a hospital or laboratory for a basal-metabolism test. Through an arrangement of tubes and bellows, the device collects products of respiration and checks up on chemical changes taking place in the body, much as an engineer might test the working efficiency of a power plant by studying the changes its fuel undergoes.

Reconditioner Gives New Oil for Old

ECONOMICALLY transforming old motor oil into new, an electric-powered "reconditioner" is declared to apply proved refinery methods. First the used oil is washed with an alkaline solution, which neutralizes all acid, frees entrained water, and precipitates nearly all of the sludge and solids. The oil then passes through a pair of replaceable filter cartridges, where resins, waxes, and any remaining water and solids are removed, into a reservoir in the base. A small hand pump withdraws the reclaimed oil for use. Inclosed heater bulbs maintain proper filtering temperature even in cold weather.





Biggest Crash Truck Salvages Disabled Army Planes

IF A U. S. Army plane "cracks up" anywhere in the Eighth Corps Area, comprising six southwestern states, the world's biggest crash truck rumbles to the spot to bring the damaged craft into Duncan Field, major aircraft repair depot at San Antonio, Tex. Measuring forty feet in length, it is so large that most ordinary-size airplanes can be picked up bodily and set aboard. A twenty-ton hoist and crane, powered by the tractor unit which tows the huge trailer, is operated in conjunction with hydraulic jacks to right the damaged craft. Only huge transports and bombers have to be partially dismantled first by the crew of skilled mechanics which always accompanies the trailer. Ten drive wheels enable the big crash truck to maneuver over all kinds of ground. Portable floodlights aid in making night repairs.



Salvaging a U.S. Army plane after a crash. Above, the fuselage is being placed aboard the world's biggest crash truck. At top, the whole plane, wings and all, is ready to roll to repair shops

Panel "Trouble-Shoots" Car's Electrical System

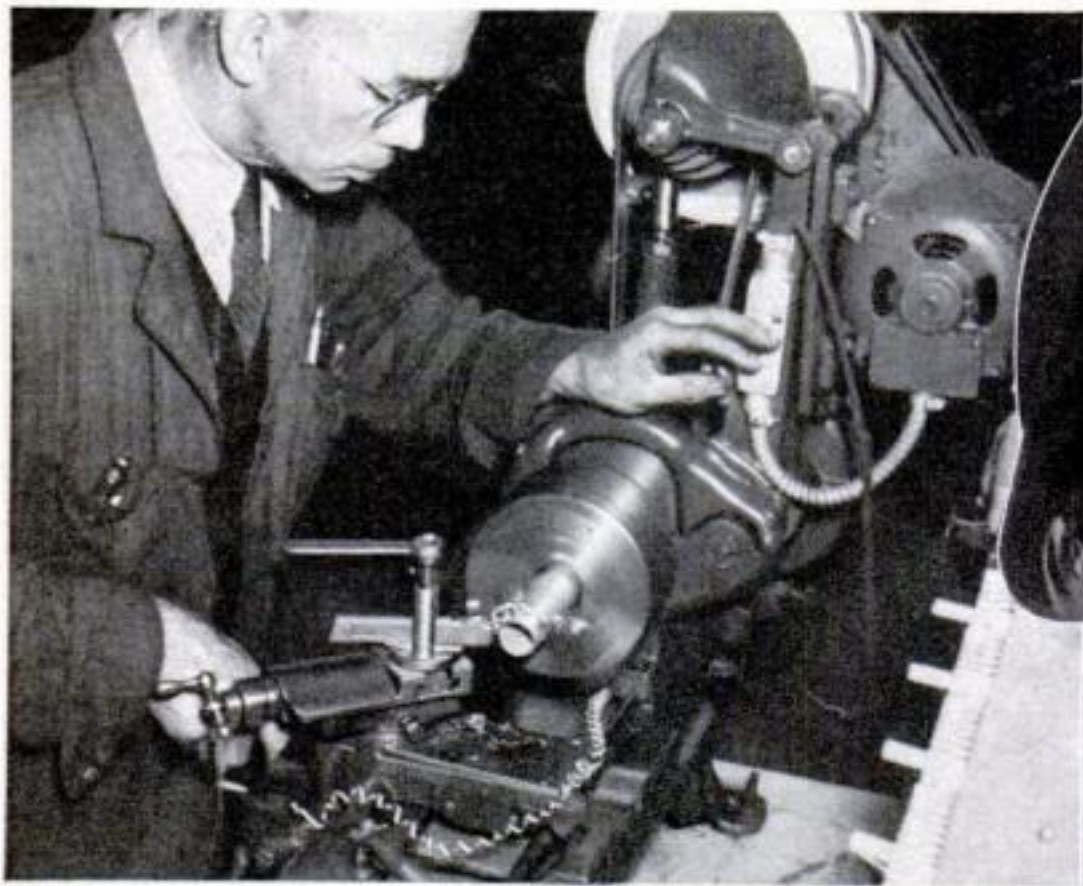
WITHIN fifteen minutes, a new test panel checks the entire electrical system of your car. Trailing cables, clipped to key points in the circuit, need not be shifted meanwhile. Simply by watching a five-dial meter while he turns control knobs, an operator detects loose connections, hidden "shorts" that slowly drain the battery, and excessive current consumption in the starting motor. Other points tested include the main battery cables, strands of which may be broken, and the battery-charging voltage regulator. Often the battery gets blamed, the maker declares, when the fault lies elsewhere.



The test panel in use, hung on the door of a car

WORKSHOPS for RENT

By L. R. MARTIN

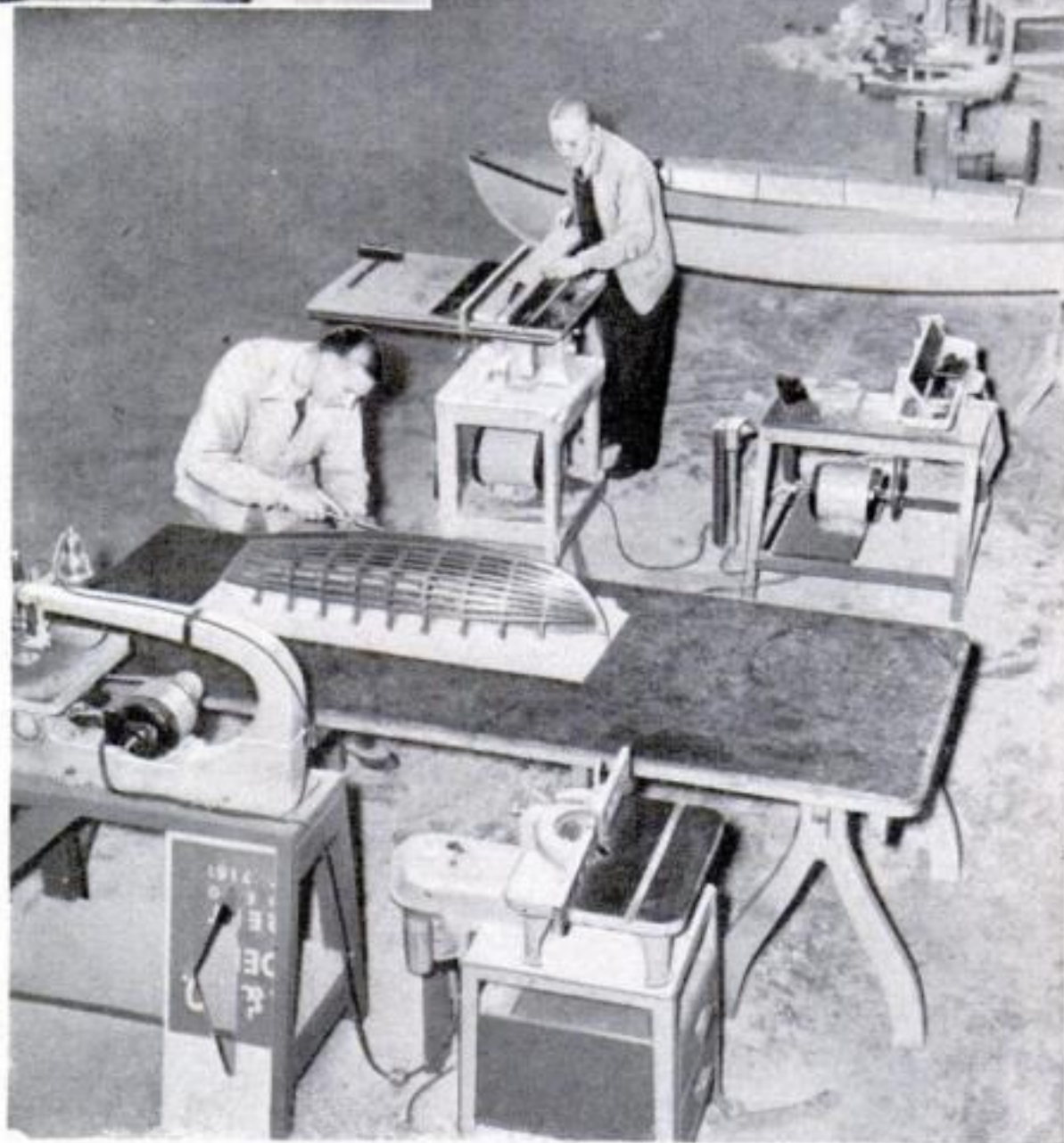


A metal-turning lathe being used by a patron of the odd Build-It-Yourself Workshop. Circle, using an arc welder



WHETHER you want to construct an end table, a model locomotive, or a full-sized sailboat, you'll find everything you need at a "build-it-yourself" workshop operated by Eddie Husted and Neal Jacobs in San Francisco, Calif. Occupying an entire floor of a factory building, the unusual establishment caters especially to amateur craftsmen who have only limited space or equipment at home. Besides standard workbenches and hand tools, it provides ambitious hobbyists with band saws, jointers, lathes, arc and acetylene welding apparatus, and a spray-painting room.

A patron may use the workshop any day of the week, Sundays and holidays included. He pays from a dollar up for weekly rental of a bench, locker, and the floor space required for his project; fifteen cents an hour for time actually spent in the shop, which entitles him to the



Benches and power tools like these are rented reasonably to anyone

use of all its hand tools, if he has not brought his own; and from five to twenty cents a quarter hour for the use of a power tool, according to its value and cost of

maintenance. He can bring along any number of his friends to help him, at fifteen cents an hour apiece, and he can hire the services of an expert mechanic for twenty-five cents a quarter hour.

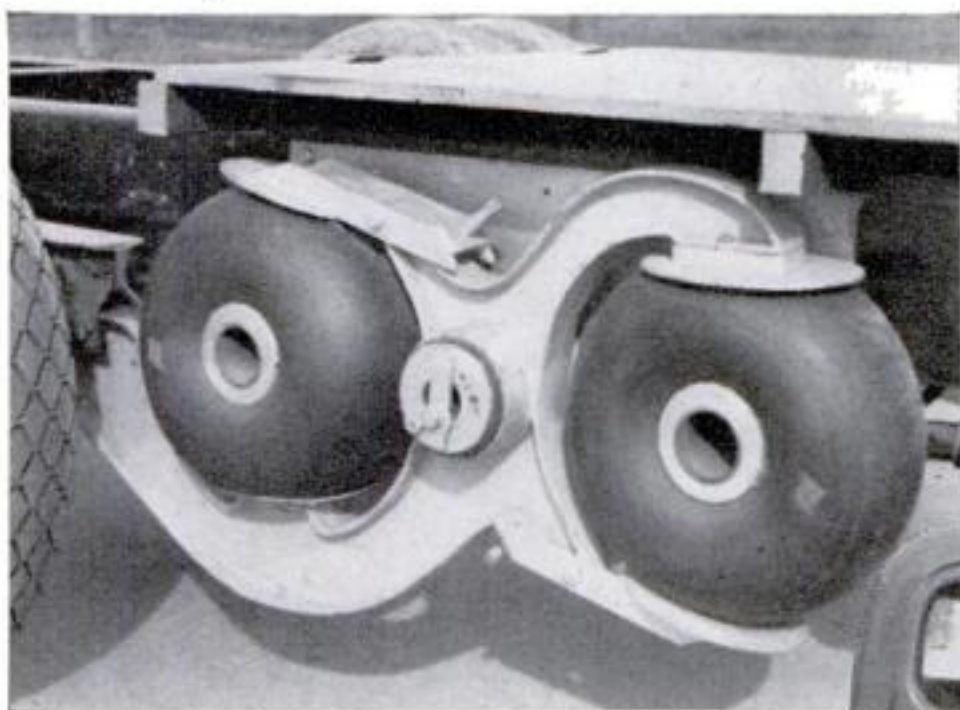
When he comes in, he receives a shop card and a supply of twenty-five brass checks, bearing the same number as his workbench. After changing to his work clothes in the locker room, he goes to the tool-supply window and exchanges a brass check for each tool he needs. When he uses power tools, he presents his shop card to an attendant, who notes the time and the charge. For construction ideas and working drawings, he may draw on the files of a well-stocked library, including back issues of *POPULAR SCIENCE MONTHLY*. Except for such items as nails and screws, the shop itself does not supply materials, but has a free purchasing service.

At this writing, twenty-five hobbyists are working on such varied projects as an auto trailer, household furniture, a model railroad, kennels for a mink farm, and a forty-foot sloop.

Sliding racks in the tool-supply room hold nearly every conceivable hand tool

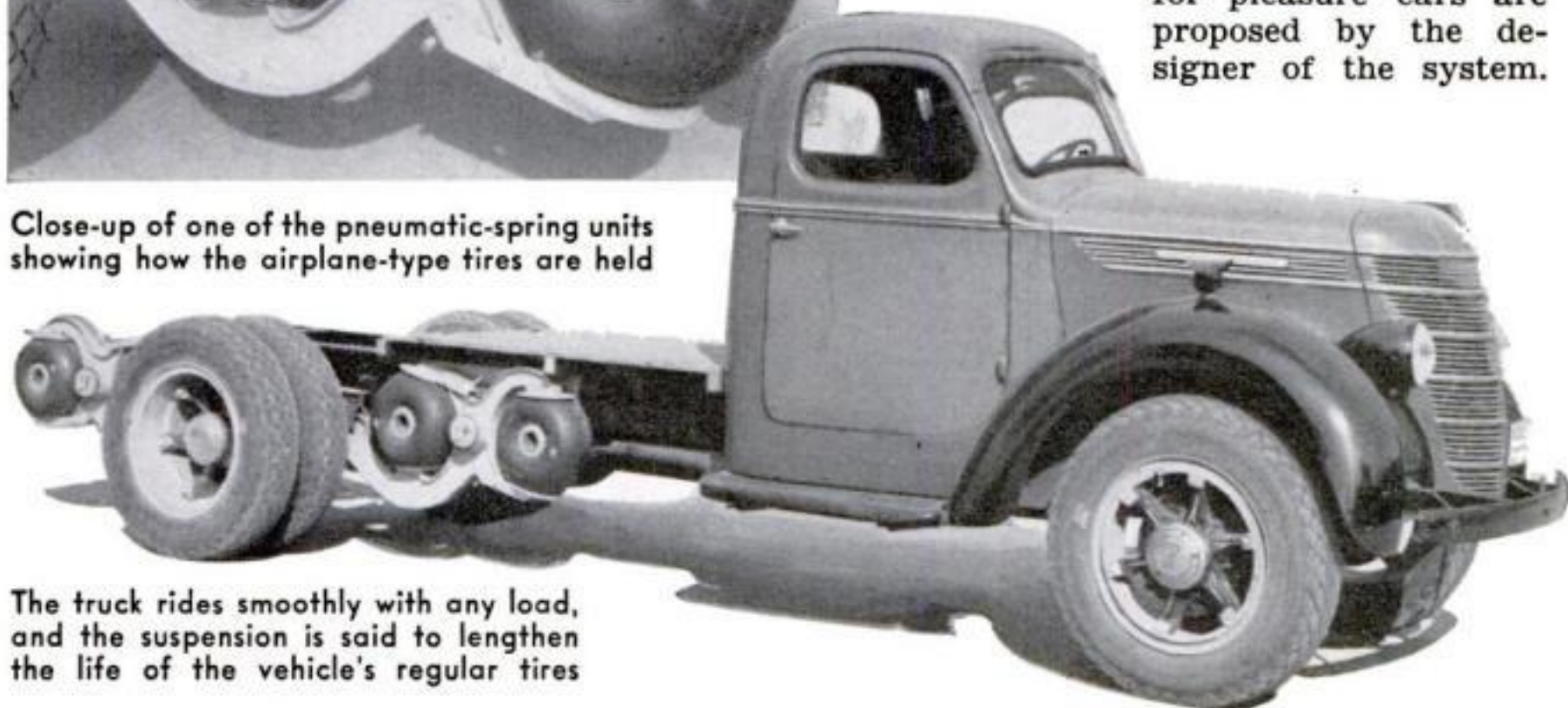


Airplane Tires Serve As Truck Springs



Close-up of one of the pneumatic-spring units showing how the airplane-type tires are held

INFLATED tires take the place of mechanical springs in a truck designed by an Indiana inventor. Four small pneumatic tires of the airplane type, mounted on each side above the rear axle, absorb road shocks and keep the load "floating." Whether the truck is loaded or unloaded makes no difference in the cushioning effect, it is said, and a marked saving in wear on the regular tires is claimed. Similar "air springs" for pleasure cars are proposed by the designer of the system.



The truck rides smoothly with any load, and the suspension is said to lengthen the life of the vehicle's regular tires



Lipstick Kiss-Tester Spoils a Nice Job

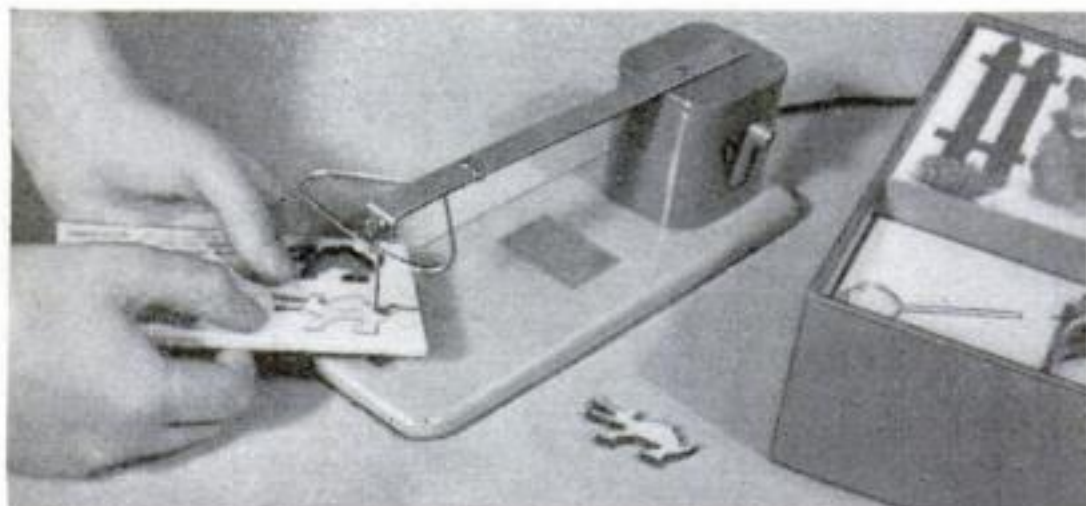
SO THAT lipstick won't come off, even when treated as above, a Hollywood Calif., make-up expert has resorted to the novel "kiss-test" machine in the foreground of the picture. Run by electricity, the oscillating osculator repeatedly presses together artificial lips of plastic—after one set has been coated with the lipstick preparation to be tested—upon a sheet of white paper. At the first sign of a visible imprint on the paper, a counter shows how many contacts the lipstick has survived. Previous experiments with live subjects showed so much variation in kissing technique and ardor that the machine was substituted.

Wall Chart Shows Growth of Child

FASTENED to a plaque on the wall, a handy washable chart may be used to measure a child's height periodically, and to mark it down together with date and weight. If indelible ink is used, the result will be a permanent record. When not in use, the chart rolls up where it is out of the way.



Silhouette Cutter Uses Red-Hot Wire



Electric cutter in use. It cuts wood, fiber, paper, or rubber

USING a red-hot wire instead of a saw blade, an electric tool for junior craftsmen facilitates the entertaining hobby of cutting out wood, fiber, and other materials in amusing silhouettes. Since the diminutive cutter is noiseless and scatters no sawdust, it may be used on any table top. Designs are supplied with the kit, and any standard 110-volt, alternating-current outlet provides the power supply.



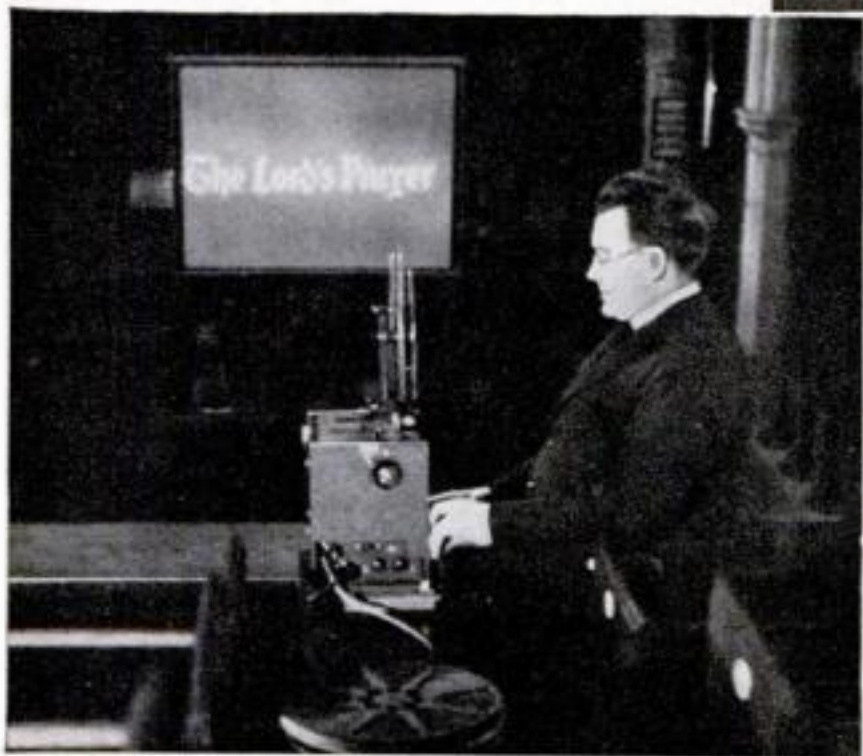
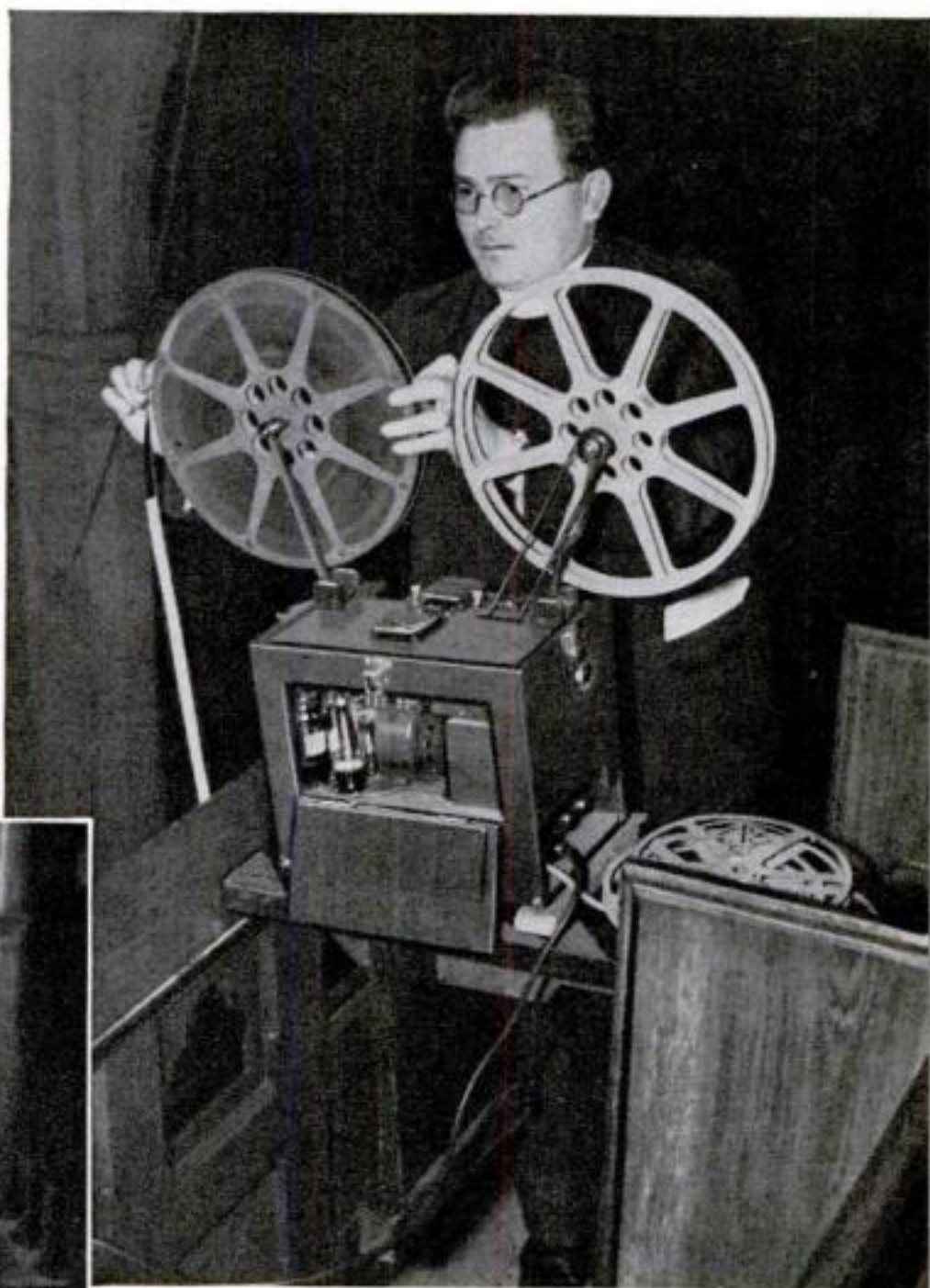
Model Plane Tows Aerial Advertisement

EASILY mistaken for a picture of a full-size airplane towing an aerial advertisement, the photograph above actually shows an innovation at a recent model meet. Watching a miniature gasoline-powered


plane soar aloft, surprised spectators saw that it was trailing a banner on a cord, a few lengths behind. The sign "Bangor," was attached to the model by its builder as a boost for his home town.

Church Services Put in Sound Movies for Small Congregations

CHURCH services recorded on sound film, complete with organ music and choir singing, have been tried out successfully in Great Britain. Offering small congregations the finest musical rendition of hymns, the "talkies" also present movies of religious subjects upon a projection screen. The illustrations below and at right show the apparatus being operated in a church at South Shields, England.




Talkie apparatus set up in the gallery of a small English church. In addition to presenting the finest renditions of hymns and organ music, the novel arrangement is used for projecting motion pictures of religious subjects on the screen, as at the left



MAKING OF AN Army Flyer

PART III



Army flyers in formation spell out "U.S.A." above the tower of the administration building at Randolph Field

A cadet at the controls of a P-12B, fast pursuit-type military plane—and apparently having a good time



A V-SHAPED flight of airplanes swept downward toward the wide expanse of Kelly Field, Tex.; glided across the long line of barracks, landed smoothly, and taxied to the far end. Still in formation, they paused briefly. The flight leader's voice came through the pilots' headphones: "Ready for take-off again."

In the control tower the dispatcher leaned toward his microphone: "Control tower to G Flight formation: All clear for take-off. Go ahead."

Keeping their positions, the planes wheeled, swept down the field and off into the air, blue fuselages and yellow wings glinting against the white clouds drifting in from the Gulf.

"This is real flying!" said Cadet Rick

Jones to himself, in the cockpit of his "BC-1" low-wing monoplane. He was flying in line with the tail of the flight leader's plane, a bare wing span between them. Behind, to the right, came another V of three planes, and to the left, still another—all grouped to form a larger V.

Rick's transfer to the Kelly Field advanced school after completing his twelve-week "basic stage" at Randolph Field, had been uneventful. He checked in at Operations, was told to read a fat bundle of printed instructions, and drew an assignment to G Flight, Section III. The parachute sergeant ran a tape over his shoul-

RICK JONES WINS HIS COVETED SILVER WINGS AFTER A BREATH-TAKING ADVENTURE BY NIGHT

ders, fitted the canvas harness snugly, and stitched it to his measurements. 'Chute, clothing, and books were stowed on a flat wicker frame suspended under his bed in the long barracks.

Next day the G Flight instructor watched his technique at the controls and quizzed him through the interphone: "What is

proper manifold pressure? Do you lean out the fuel mixture as you go up? How do you figure the power developed, from the 'inches of mercury' dial on the dash?"

Rick also was learning to use the radio compass, to locate himself and fly in by this "homing ring." He mastered the gyro compass and gyro horizon, then flew blind,

under the hood. Back now to the Link Trainer, known as the "jeep," for a daring maneuver, the famous "Army Two-Station Let-Down."

Then, back to the air again. The instructor, leading half a dozen cadets, took off for a city eighty miles away. Each

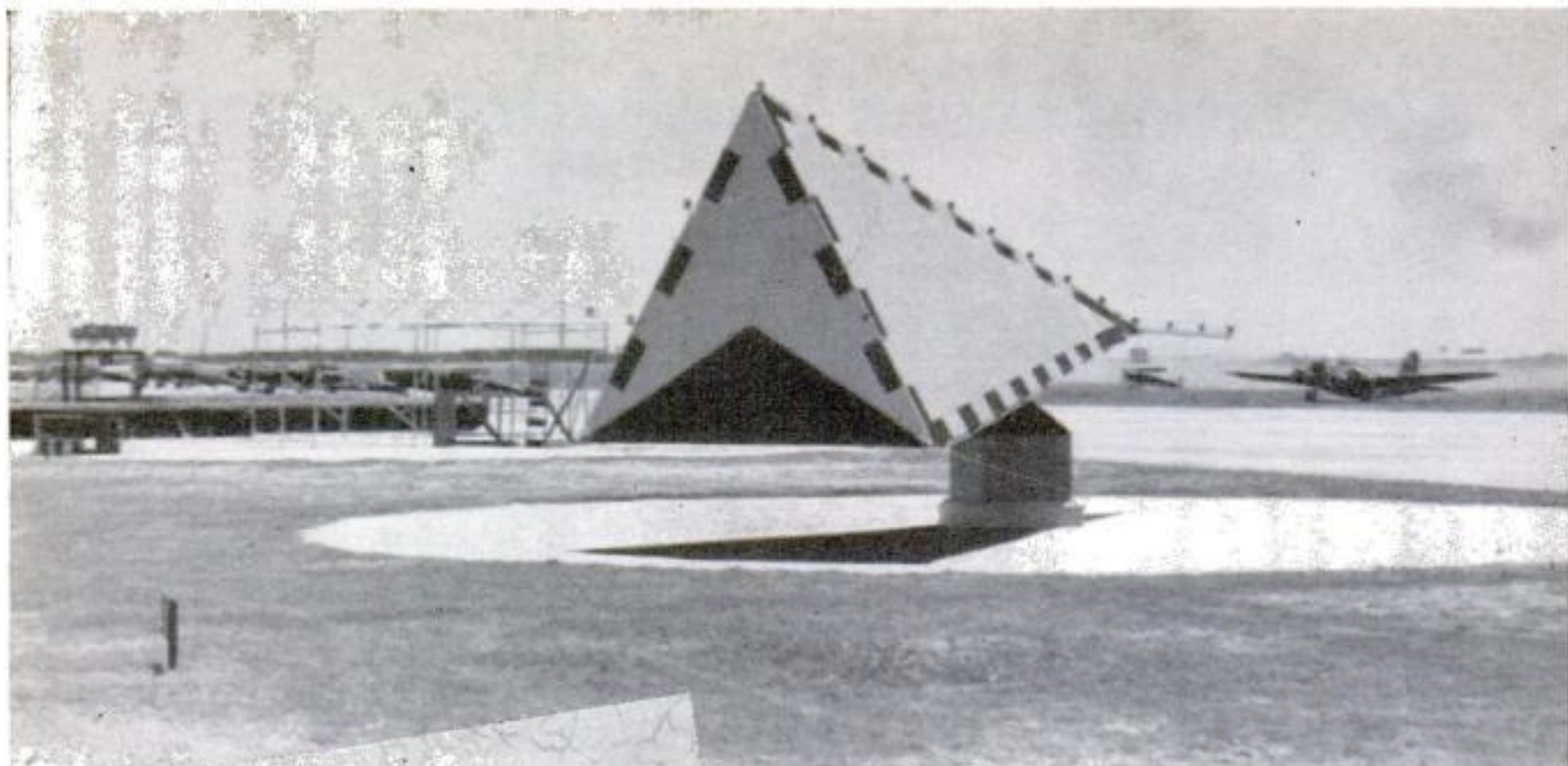


Formation leader giving signal for a turn

By
**STERLING
GLEASON**



In trouble-shooting class, students spot engine faults with a motor mounted in a test block. The wire cage in the background shields the whirling propeller



This giant wind T guides flyers landing at Kelly Field

cadet branched out to a different point, and navigated back to fall in line again at a designated location. Only thirty seconds' leeway was allowed for the meeting. It was quite a feather in the cap of G Flight when the entire group completed the "time-and-distance problem" by stringing into Kelly Field scarcely 100 yards apart.

THE sun was sinking across the flat Texas prairie as Rick took off from Brownsville. To the left, the Rio Grande wriggled its sluggish way toward the Gulf, dimly visible in the eastern haze. Before and behind, Section III was strung out over a dozen miles. Every three minutes a cadet joined the flight, the long-awaited cross-country "mission" climaxing the



Studying a map in preparation for a cross-country flight. Plans are formulated in great detail, and perfect timing is required in carrying them out

Invitations like this summon guests to the graduation exercises that mark the end of the rigorous training course

*The Air Corps Training Center
requests the honor of your presence
at the Graduation Exercises*



Post Theater, Kelly Field, Texas

9:30 A.M.

August 25, 1939

whole course of training.

As the dusk deepened, a single point of light winked ahead. Rick flicked on his navigation lights, set the rudder fletner and stabilizer, leaving the plane to fly itself hands-off, and settled back for a comfortable ride. A second light appeared in the distance. Looking back, he saw a third beacon. He was accurately on course, a straight flight that would land him at Kelly Field, 300 miles away, within the allotted time.

It was quite dark, except for an occasional patch of lights on the distant horizon, with only the line of beacons visible. But he noticed that the distant light swam hazily. The one he had just passed quickly dimmed, the third had disappeared.

"When you see only two lights, be careful; when only one, look for a spot to land." That was the G Flight instructor's last word before they left Brownsville. Rick reached for his flash light and consulted the map strapped to his knee.

Fifty minutes at 120 miles an hour placed him 100 miles north of Brownsville. There was gas enough to carry him to San Antonio, with an hour's supply in reserve. He twirled the radio knob for weather reports, but no luck.

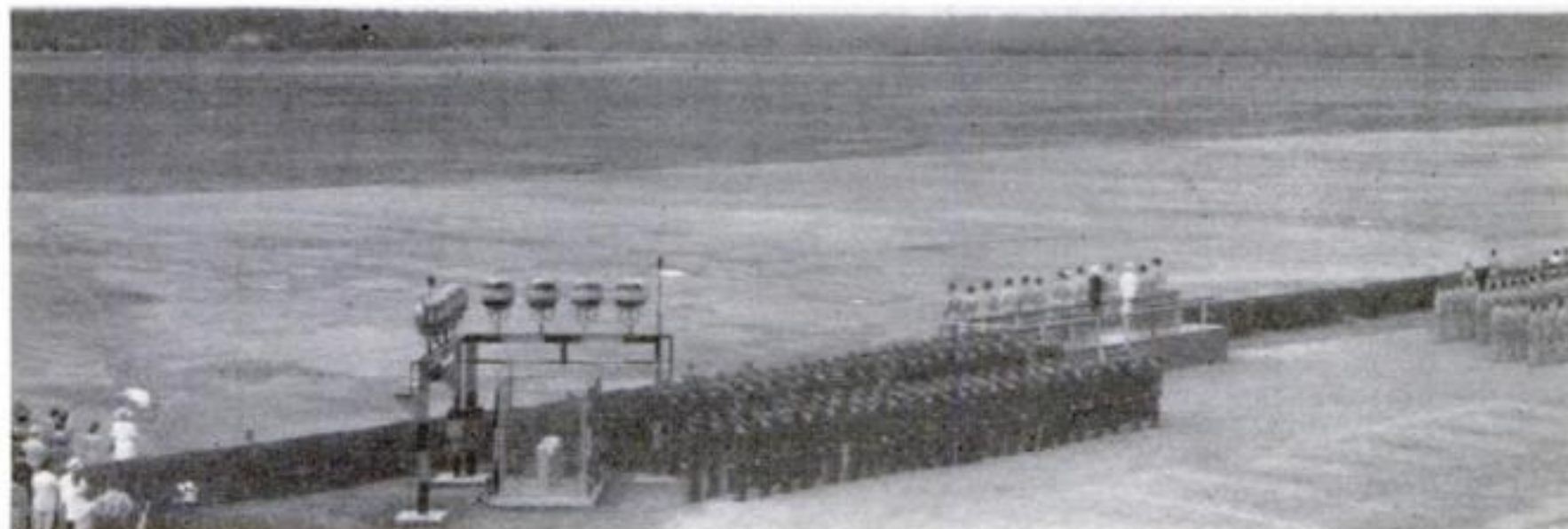
Splash! A drop of moisture landed on the back of his (Continued on page 236)



For the last time, the graduating class stands inspection at Kelly Field



The climax of a career at the West Point of the Air—receiving his diploma and the silver wings



New flyers for Uncle Sam: members of the graduating class "pass in review" before the cadets and officers

Tiny Symphony Orchestra Aids Music Students

"WHAT sections of the orchestra are playing now?" When music students, listening to phonograph recordings of symphonies, ask that question, Julius Liss, Newark, N. J., music teacher throws switches on a panel he holds in his hand. This lights up sections of a miniature orchestra. The electrical model, Liss claims, teaches students to recognize the various instruments as they blend in a symphony.



Sections of the model orchestra are lighted up as switches are thrown

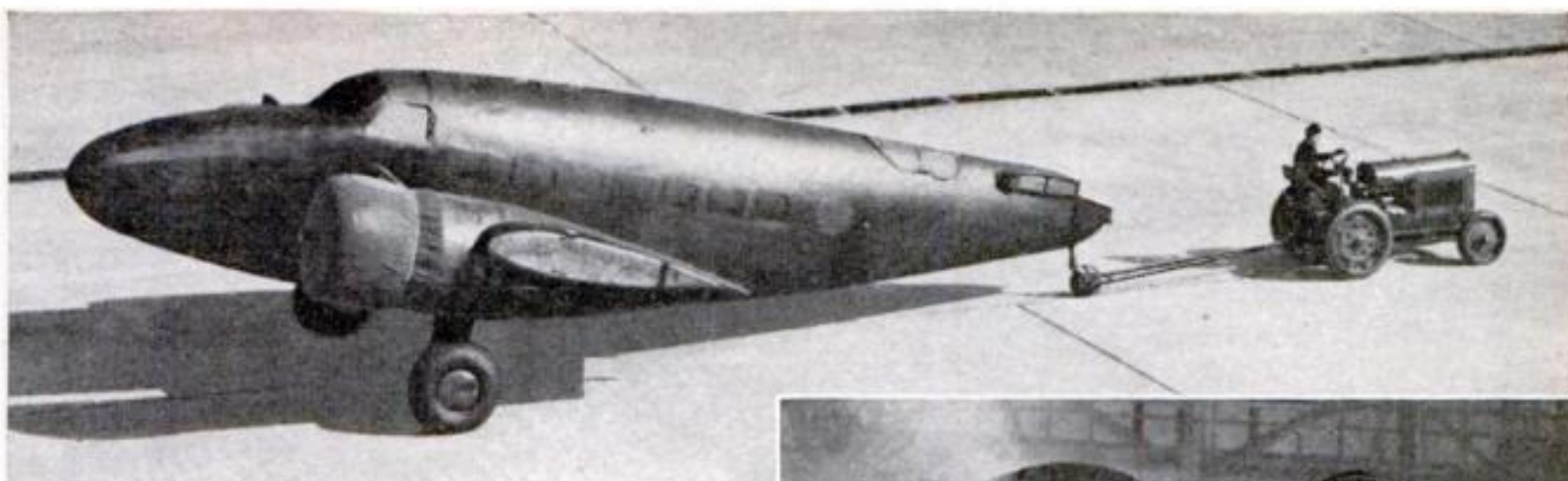
Sound-Track Recorder for Home Movies

NARRATION can be "dubbed in" on amateur moving-picture films with a recording apparatus just introduced. When the developed movie film is threaded into the device and a speaker talks into the microphone, a sound-recording needle indents a sound track into the film between the sprocket holes and the picture frames, much as a recording needle grooves a phonograph record. The same

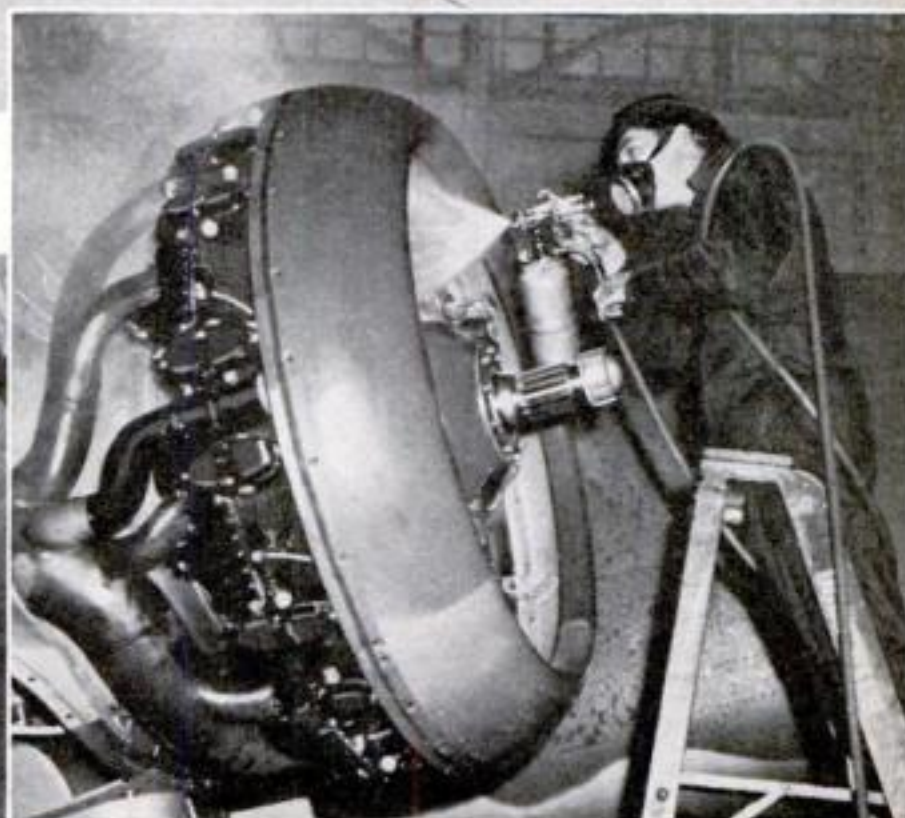
sound head used for recording is employed to reproduce the sound when the film is projected onto a screen.



"Dubbing in" sound on home movies. A needle in the sound head, above, cuts a sound track on film



Sealed at every opening or joint, this fuselage is ready for its steamship journey



Engines are sprayed with grease before being covered. Left, applying masking tape to the bomb-hatch edges to prevent corrosion

Planes Are Weatherproofed for Voyage

MASKING tape and a grease compound are now being used to protect huge bombing planes being prepared for shipment abroad. Every exposed opening or joint on the plane, from the bomb hatches under the fuselage to its windows, are sealed with

black masking tape against the rigors of an open-air steamship voyage across the Atlantic. Before protective hoods are set in place, the plane's motors are coated with a special waterproof grease sprayed on by workmen wearing protective masks.

Artificial Flowers Can Be Washed

ARTIFICIAL flowers made by a novel process from the materials of a recently marketed kit are both moistureproof and dust-proof. The flowers are scissored out of extra-heavy paper, the petals being shaped before they are pasted together to form a bloom. Delicate gradation of tone in the coloring of the flowers is obtained with the use of crayons. Then after the flower is complete, it is covered with a special lacquer that gives it a porcelainlike quality and adds to its durability.



The flowers are cut from heavy paper and then lacquered



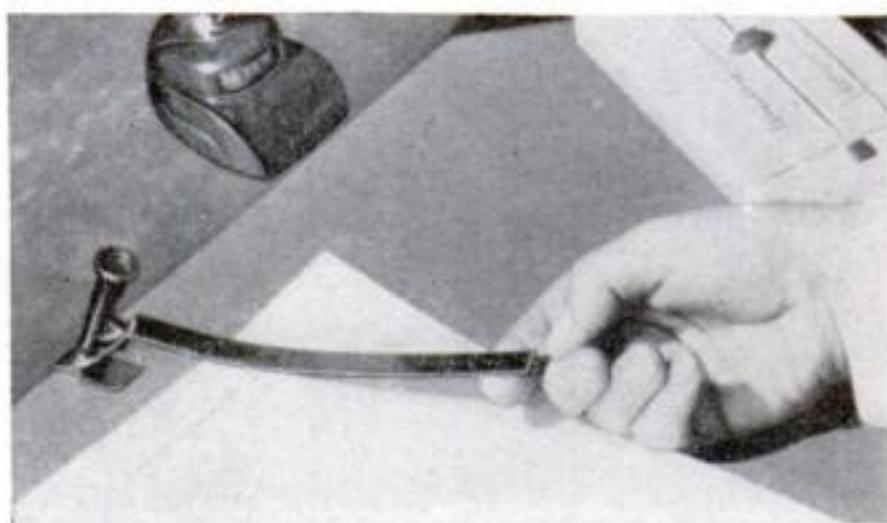
Measuring the pelvis bone of the huge prehistoric elephant

Huge Prehistoric Monster Unearthed by Steam Shovel

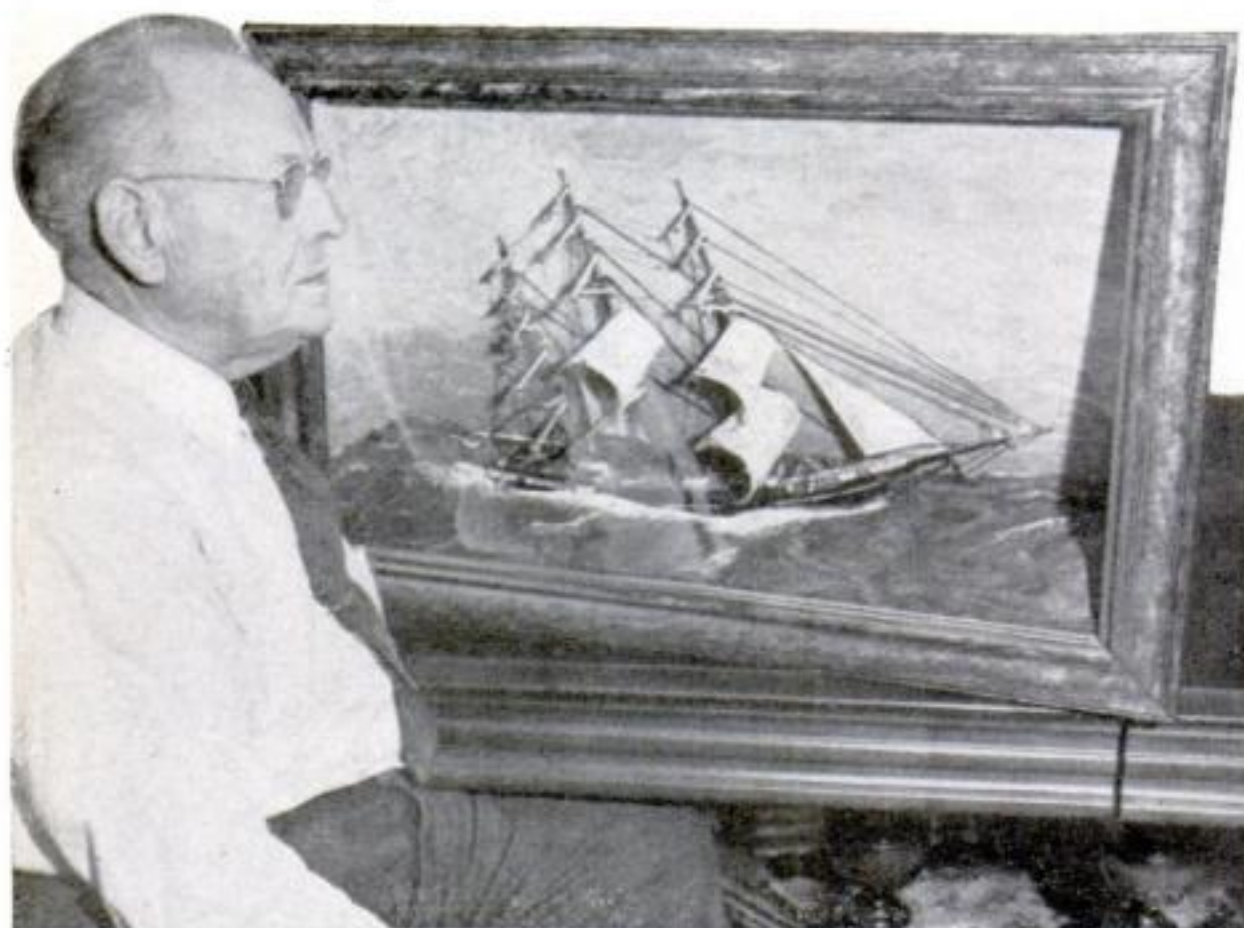
DISCOVERED by accident thirty feet underground at Highland Park, Calif., when a steam-shovel bucket exposed it to the view of workmen, the fossilized remains of a huge prehistoric elephant that roamed the West Coast countless centuries ago are being studied by scientists of the California Institute of Technology. Work on the excavation was halted while they carefully uncovered and removed the huge mammal, which is being taken to the institute for assembly.

Two-Purpose Paper Weight Clamps on Desk Blotter

SOMETHING new in paper weights has just been placed on the market. It consists of a strip of springy steel which is held by an adjustable clamp to the top of a desk blotter. The free end is then easily lifted and the strip placed on top of loose papers on the blotter. The clamped end has a socket for a pen or pencil.



His Ship Models Sail Realistic Oceans

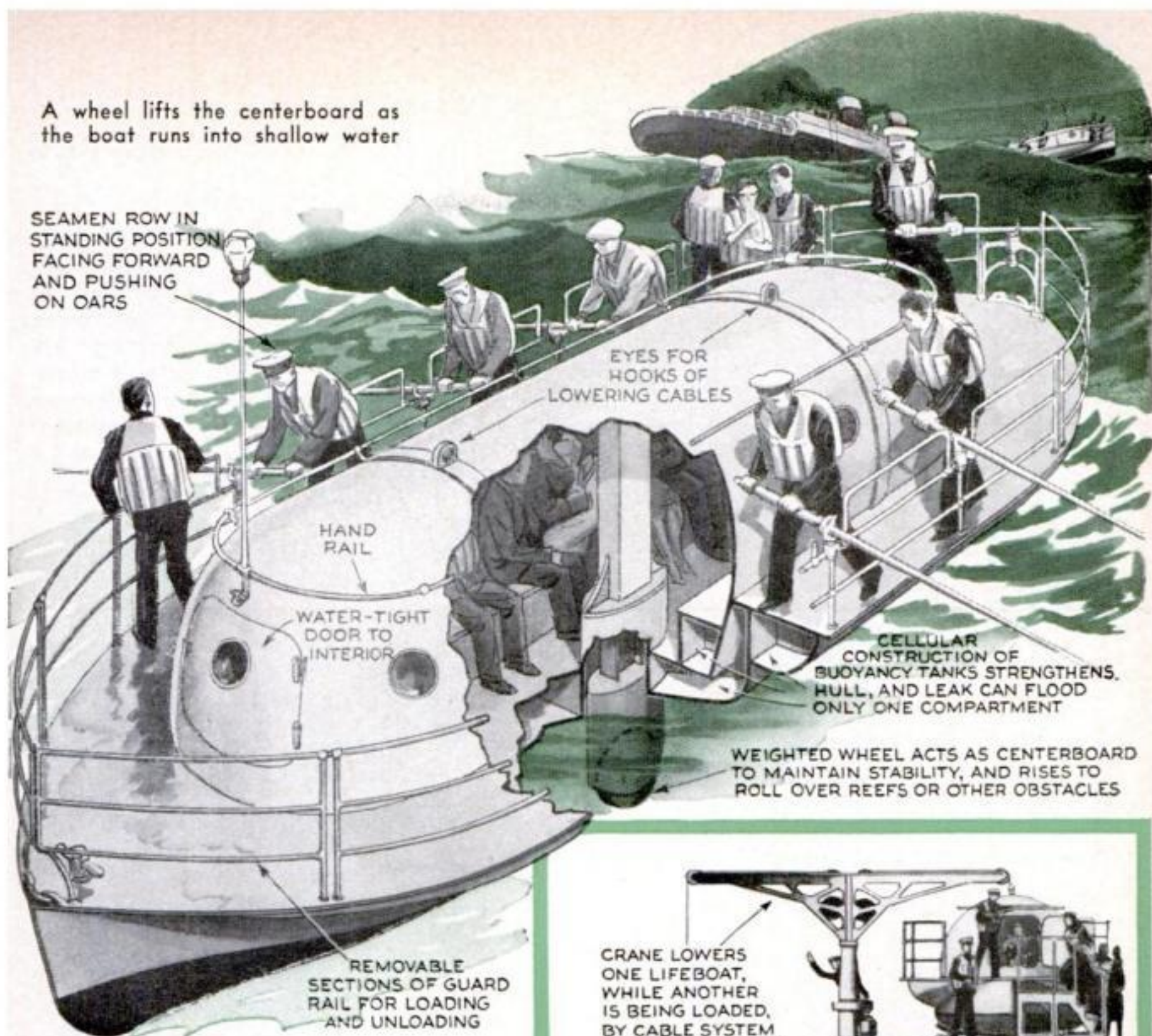


S. B. Josselyn with one of his models mounted to appear in relief

SPECTACULAR realism marks the ship models made by S. B. Josselyn, retired merchant of Inglewood, Calif. Not content simply to tell his friends of their seaworthiness, he mounts the carefully constructed vessels in special frames containing imitation seas, clouds, and skies that duplicate with a remarkable three-dimensional effect the stormy oceans the models' prototypes once sailed. The backgrounds of his scenes are painted by hand on canvas sloped slightly forward, while the ships themselves rest on painted oceans.

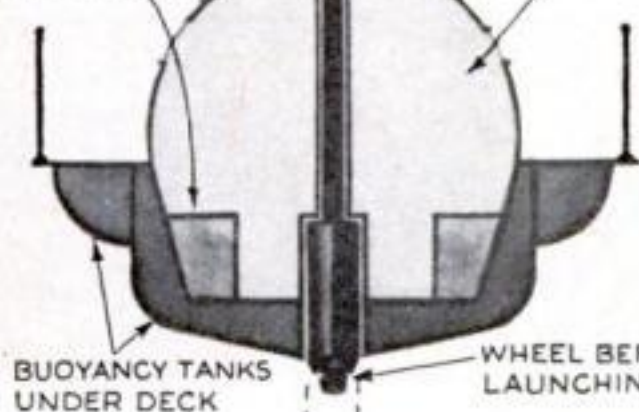
A wheel lifts the centerboard as the boat runs into shallow water

SEAMEN ROW IN STANDING POSITION FACING FORWARD AND PUSHING ON OARS



LOCKERS UNDER SEATS HOLD FOOD, WATER, AND SIGNAL ROCKETS

PASSENGER COMPARTMENT



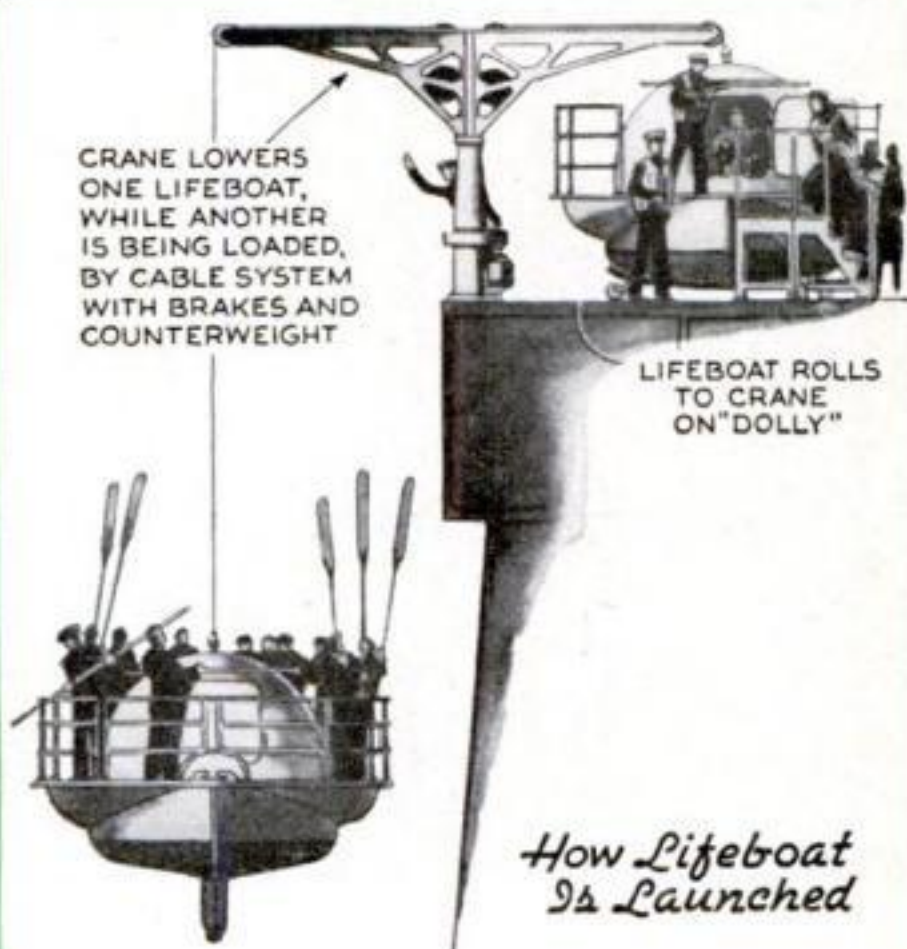
BUOYANCY TANKS UNDER DECK

WHEEL BEFORE LAUNCHING

WHEEL LET DOWN AS BOAT IS LOWERED TO WATER

CRANE LOWERS ONE LIFEBOAT, WHILE ANOTHER IS BEING LOADED, BY CABLE SYSTEM WITH BRAKES AND COUNTERWEIGHT

LIFEBOAT ROLLS TO CRANE ON "DOLLY"



How Lifeboat Is Launched

Safety Lifeboat Cannot Tip or Swamp

UNSINKABLE lifeboats would be loaded and launched from a foundering ship with rapid-fire speed, in a plan proposed by William L. Wheeler of Hondo, Calif. Stored on wheeled dollies in rows along each deck, the boats are rolled to double-action cranes that take the place of davits. When cable hooks have been made fast, the swiveling

crane permits the loaded boat to be pushed over the side, and a friction brake checks its descent to the sea. Water-tight doors lead to a stormproof cabin of the lifeboat, and air tanks provide reserve buoyancy, while a heavy "centerboard" with a wheel at its bottom telescopes into a housing when the craft enters shallow water or is beached.



Huge Yam Tips the Scales at Twenty-Six Pounds

EIGHTEEN inches long, and tipping the scales at twenty-six pounds, the giant yam pictured above was raised by Carl Stroschein, of San Juan Capistrano, Calif. After the huge success of this experiment, Stroschein is now considering raising the yams on a commercial scale.

Device Reveals Ground to Fog-Trapped Plane Pilot

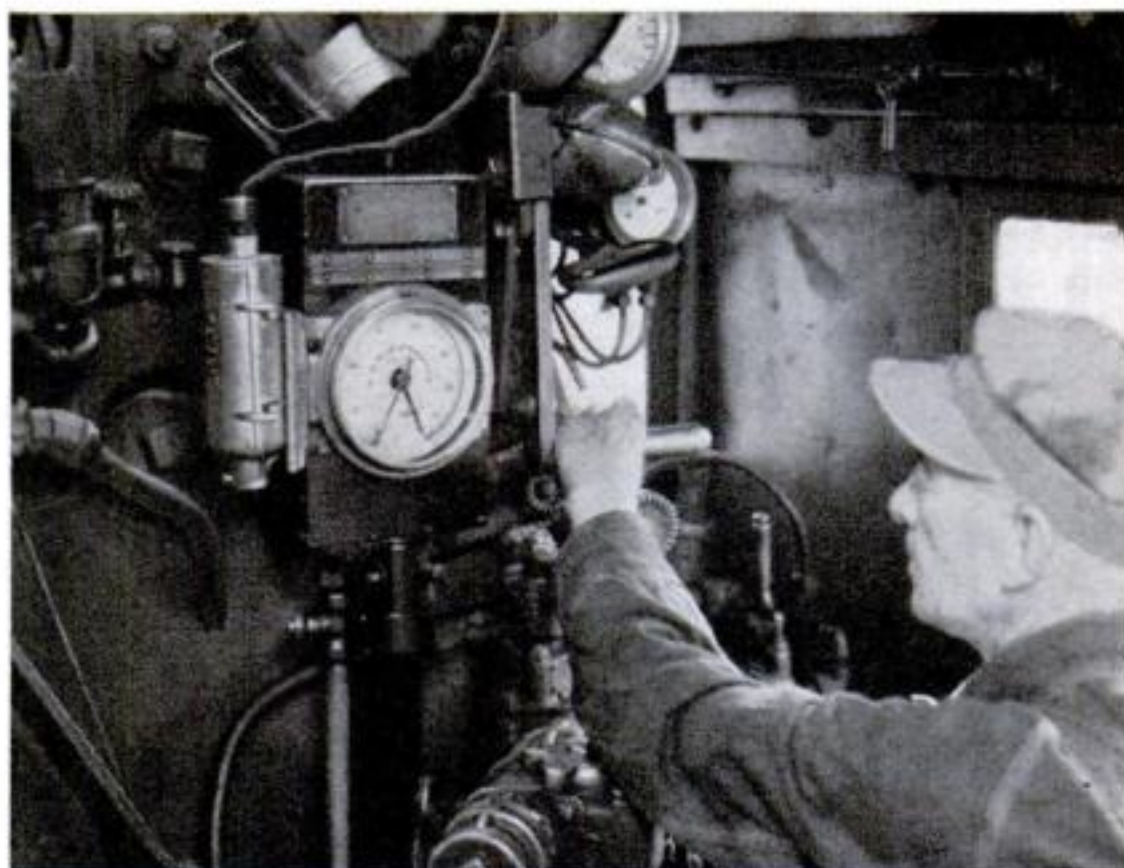
AIRPLANE pilots will be able to guide their planes through dense fog with the aid of a novel "fog eye," according to its coinventors, Guy Ball and W. L. Cummings, who exhibited a model of it recently in Glendale, Calif. The instrument employs a photoelectric cell sensitive to fog-penetrating infra-red rays. By means of this and a special reproducing camera, the pilot sees a fogless moving picture of the terrain below him on a "television-type" viewing screen mounted on the instrument panel.

The instruments that give a pilot a view of ground despite dense fog



Control Boosts Locomotive Efficiency

GREATER efficiency and economy for steam locomotives is made possible by an instrument just developed. Installed in the engine cab, the device has a dial with two pointers, one showing the exact speed of the locomotive and the other indicating the most economical and efficient point for adjusting the steam supply to the cylinders, a procedure known as the cut-off. In addition, the apparatus includes a recording device by which a complete record of the locomotive speed and its cut-off during a run is registered on a moving paper tape. Thus the railroad has a written record of how the engineer handles his locomotive.



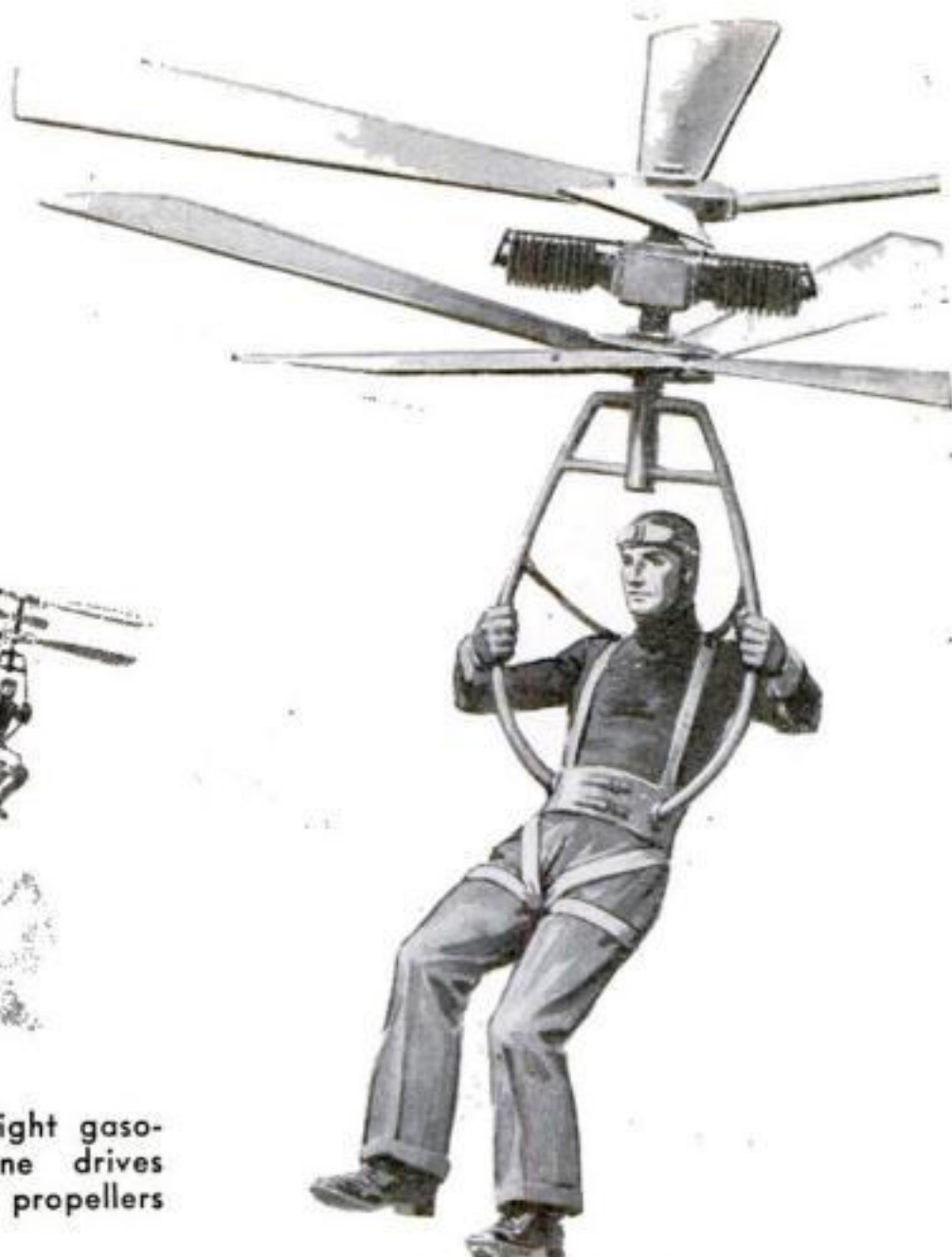
A glance at the dial shows how much steam to feed the locomotive

One-Man Helicopters Give Soldiers Wings

SOLDIERS hurling themselves across wide streams at a single leap, charging over battlefields at high speeds, flying across wide trenches and gaping shell holes in a series of broad jumps—that is the picture envisioned by George de Bothezat, of New York City, inventor of a curious one-man helicopter. Consisting of two propellers mounted on a vertical axis and driven horizontally in opposite directions by a lightweight gasoline engine, the apparatus is anchored in a framework over the head of the user, who wears a special belt-and-harness support. The machine, controlled in the air by body, arm, and leg movements, might also be used by sportsmen.



A lightweight gasoline engine drives the twin propellers

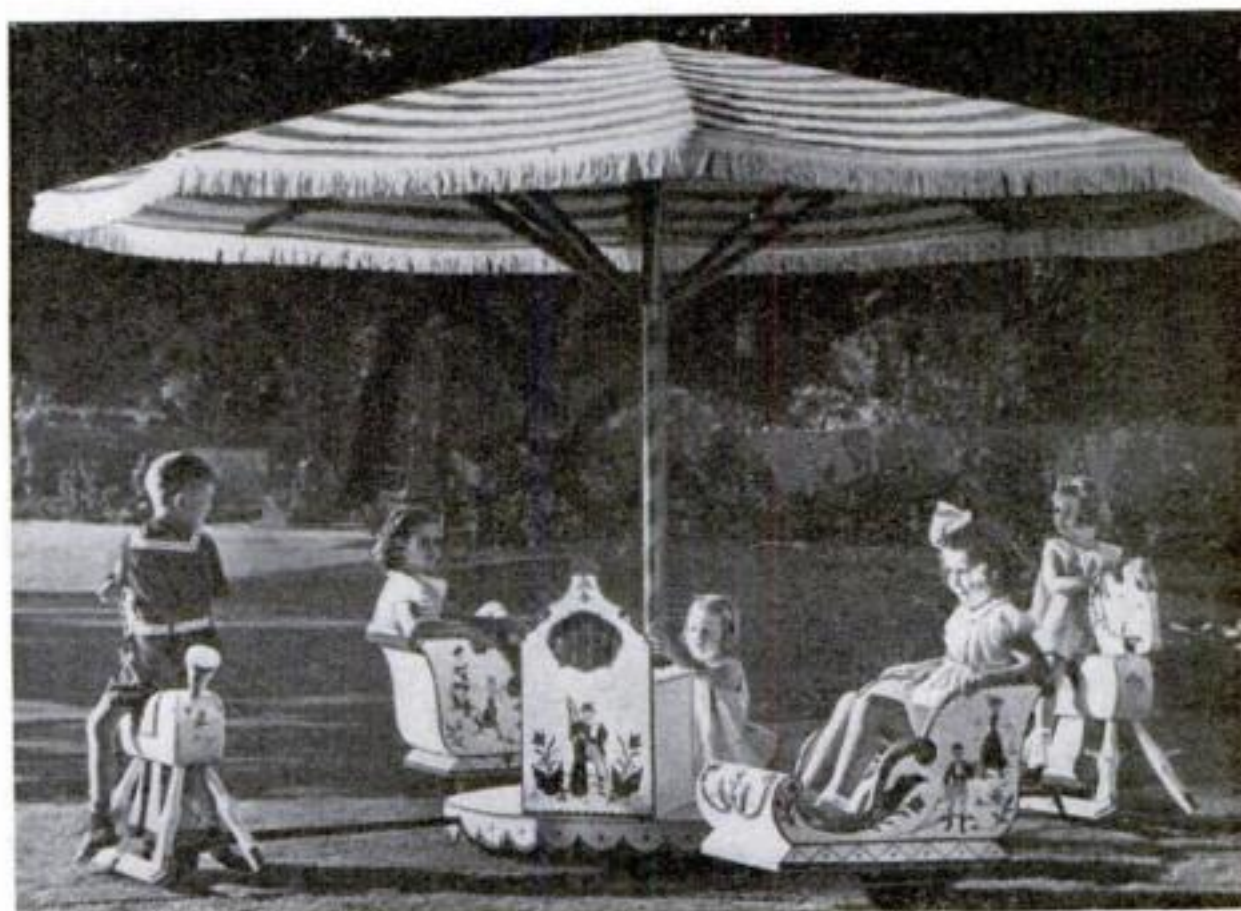


Novel Medicine Doser Is Two Spoons in One

MADE for measuring doses of medicine, a new hammered-silver utensil has a tablespoon hinged at one end and a teaspoon at the other. The combination folds up when not in use.

Electric Motor Runs Children's Carrousel

PLUG a connecting cord into an electric socket, and the novel children's merry-go-round pictured at the right begins to whirl merrily. Covered by a gayly colored awning and providing two wooden horses and two decorated chairs, the carrousel also has a built-in electric record player to furnish appropriate music for the young riders.



Just plug in the cord, and this electric merry-go-round is ready to run



Ralph L. De Gayner at work on a spray-gun painting

Spray-Gun Artist Paints with Automobile Enamel

PAINTINGS made with a spray gun instead of a brush, and with automobile enamel in place of oil colors, form the specialty of Ralph L. De Gayner, of Channing, Mich. Six years ago, he began experimenting with the new technique for turning out landscapes. Now, he is able to produce a winter scene, by his spray-gun technique, in five minutes. With his two sons mixing enamel and his wife operating the air compressor, De Gayner produces pictures in quantity.

Transparent Face Mask

SLIPPED over the head, a bag of cellulose tissue designed for use in skiing and other outdoor sports offers protection for the face without interfering with vision. The transparent mask can also be used as a shower cap, an apron, a tray cover, and a turban, the makers say.



Motorized Mower Uses Rotating Disks

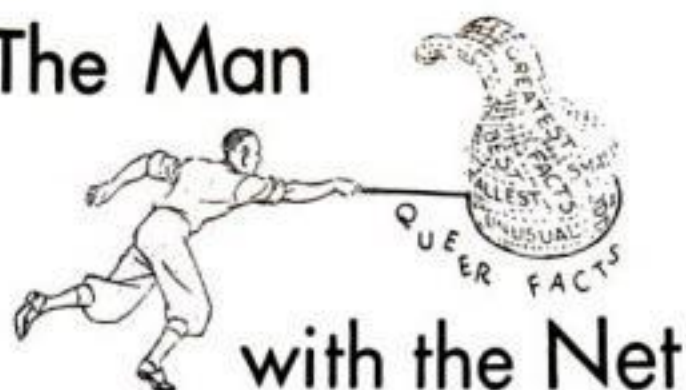
WITH three cutting disks whirling at high speed beneath the chassis, a new motorized mower invented by Lewis Bishop, of Arcadia, Fla., is capable of cutting a seven-foot swath while traveling twenty miles an hour.

The disks, which can be set to cut anywhere from a quarter of an inch to eight inches above the ground, can slice through cane or bushes an inch thick, as well as through the finest of grass.



This novel mower can cut fine hay, or bushes an inch thick. Arrow points to one of the cutting disks

The Man



with the Net

CENSORS in France use infra-red light, in some instances, to read letters without opening the envelopes.

WALNUT SHELLS have been used to pave a road in California.

AMERICA'S LARGEST BIRD, the California condor, is 5,000 times as large as America's smallest bird, the calliope humming bird.

AND I THOUGHT
IT JUST ANOTHER
BUG!



UNITED STATES CITIZENS each winter have approximately 200,000,000 colds.

CONTINUATION of the present decline in birth rate will mean that about 1975 no babies at all will be born in the United States.

ELEVEN kinds of vitamin B are now known to science.

WATER in the Pacific transmits less light than water in the Atlantic.



SEVEN MILLION dollars a year is spent for research by one American corporation.

BIRDS instead of books are kept at a unique "canary library" in Michigan. The proprietor lends out his song birds free to cheer up invalids.

FOUR-LEAF-CLOVER plants are grown for market by an Iowa gardener.

NEXT IT WILL BE
RABBIT'S FEET IN
A GRAVE YARD!

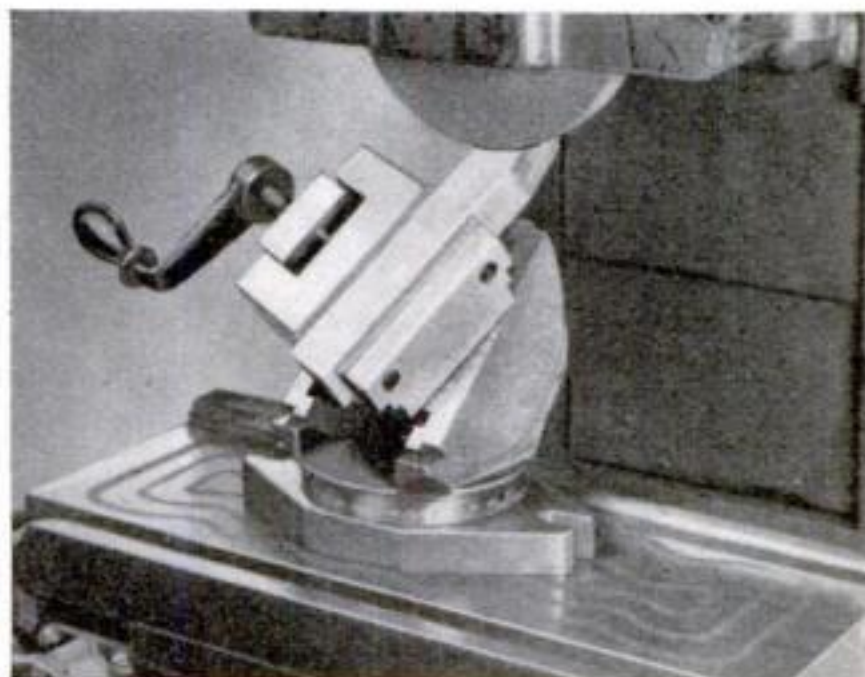


Metal Edges for Skis Give Smooth Joints

To GIVE a smooth surface with all screw heads hidden, a new-type metal edge for skis is provided with "keyhole" slots on its under-side. These slots slide over the heads of screws placed in the ski and serve to hold the edge securely in place.

New Machine-Tool Vise Adjustable Three Ways

LIGHT in weight, portable, and of all-steel construction, a new type of universal vise designed for milling, grinding, and drilling operations is adjustable in three separate planes. Graduated scales in each of its planes make it possible to adjust it for a complicated angle of operation as easily and quickly as for a simple angle.



Universal machine-tool vise in use. Adjustable in three planes, it holds work at any angle required

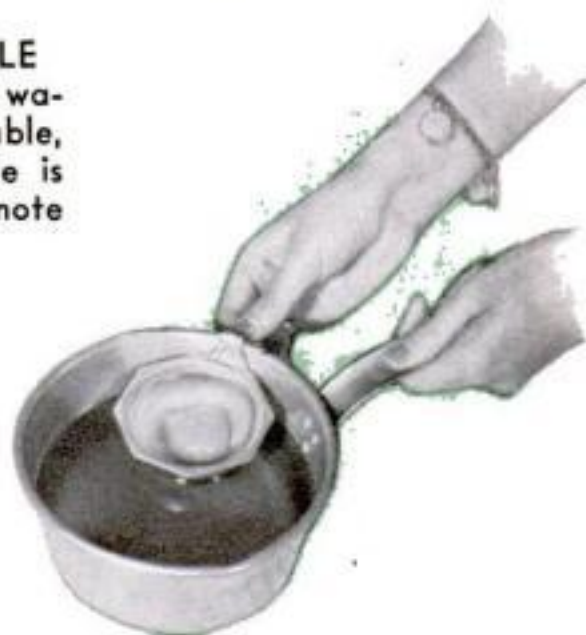


NONSKID BATH SPRAY. Sprayed into the tub before water is run, a new preparation is said to leave a film that prevents falls



WATER-LILY CANDLE
Floating in a bowl of water on the dinner table, this lily-shaped candle is a novel decorative note

EGG POACHER
Any saucepan may be used for egg poaching with cups like that shown at right. Cups hook on edge of pan above water or food



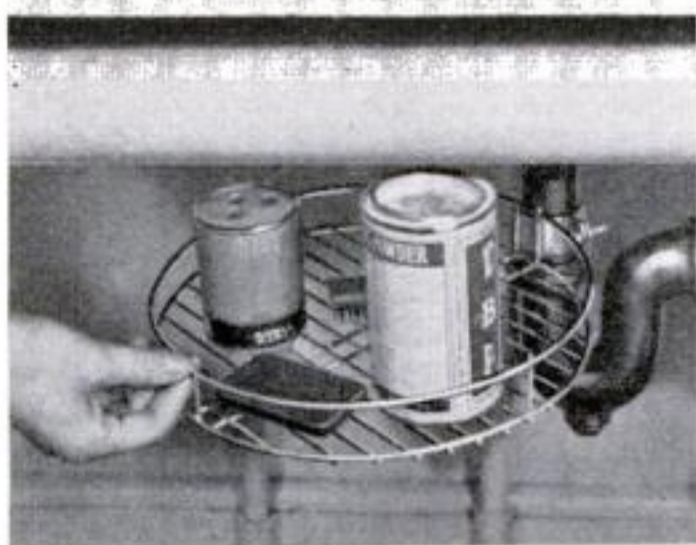
CUTTING A CAKE is made easy by this chrome-plated ring fitted with radiating spokes of fine wire. The ring is placed over the cake and the wires pressed through it

KITCHEN VENTILATOR. A centrifugal exhaust in the ventilator at the right forces all cooking odors and vapors out of the house, and a grease trap keeps ceiling and walls clean



BISCUIT BAKER. Crisp, golden-brown biscuits are baked in the electric cooker at the right, which is said to throw off no more heat than a mere toaster

UNDER-SINK SHELF. Easily attached to the drain pipe of any sink, the wire shelf below is handy for keeping scouring powder, sink brushes, and other items



THIRST EXTINGUISHER. Raging thirsts are promptly quenched by beverages poured from the distinctive drink mixer pictured below, which resembles a fire extinguisher



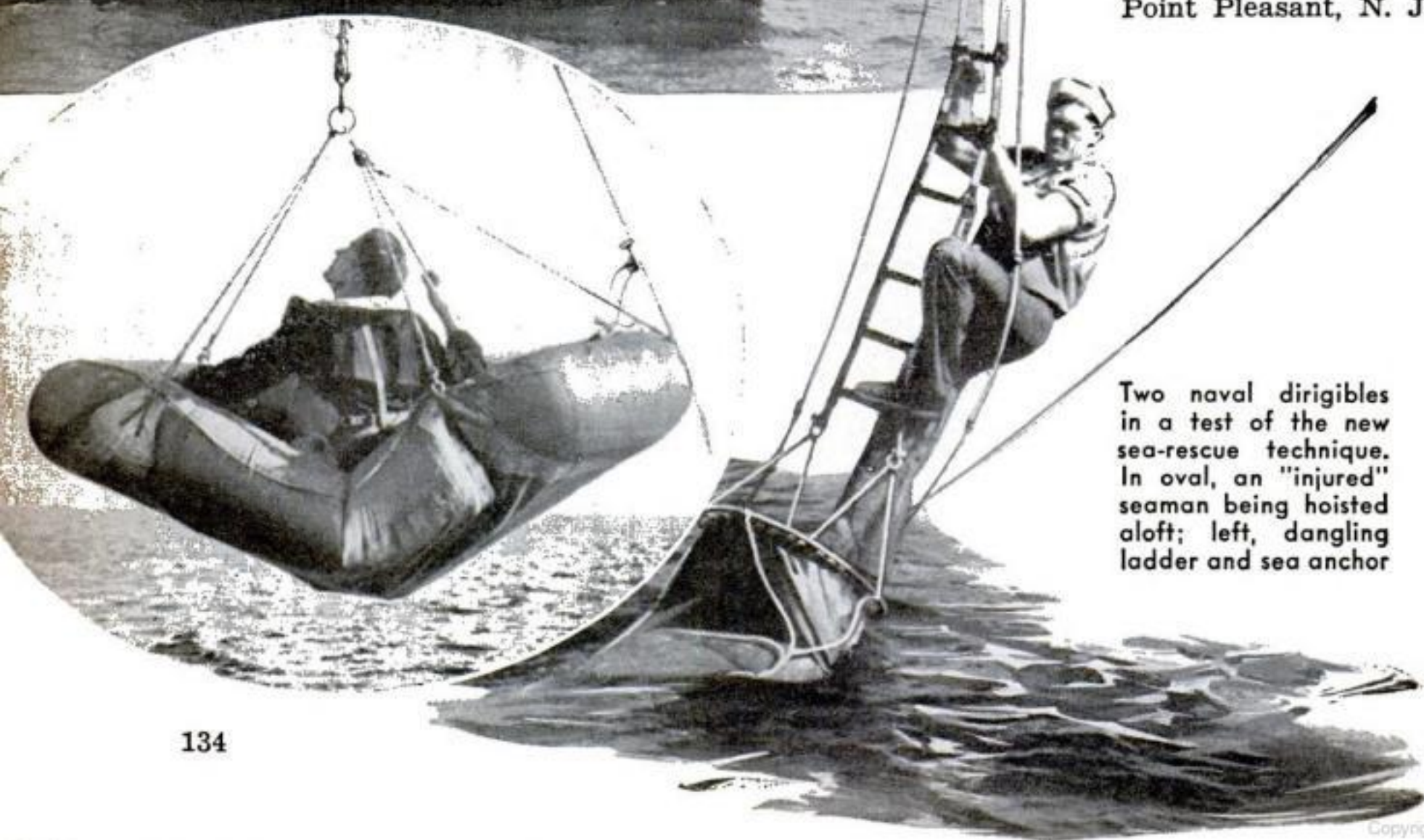
SOCK PATCHER
Socks are mended without sewing, by this new appliance. A sock is placed as shown above and a prepared patch is applied. The top (left) is put on, and heat is applied electrically to seal the patch in place



U. S. Navy Blimps Learn New Rôle for Sea Rescues

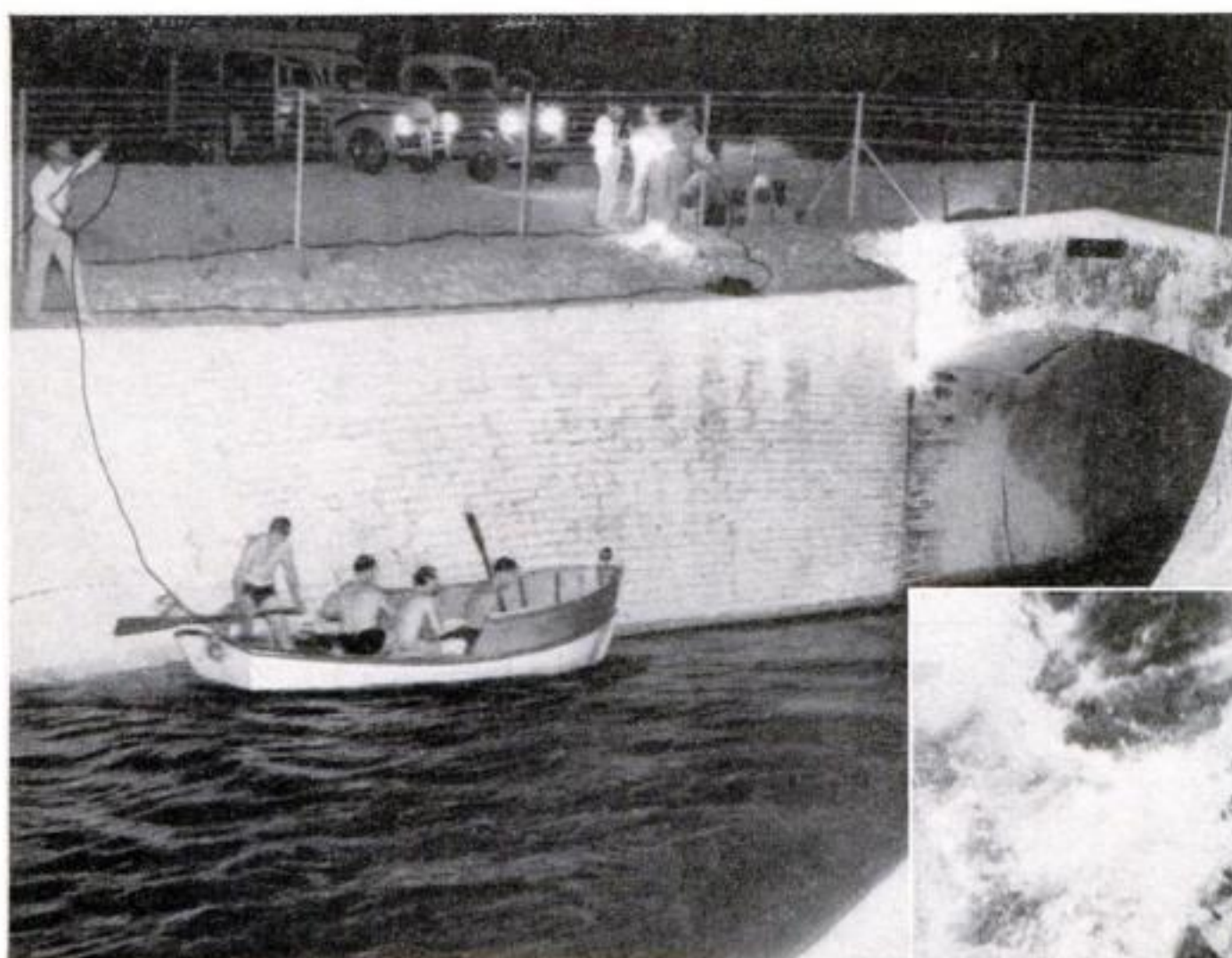
WITH the aid of new airship inventions, U. S. Navy blimps can now "anchor" 100 feet above the sea, and pick up ill sailors or victims of shipwreck. A circular

disk called a "drogue," dropped into the sea at the end of a cable, keeps the craft's nose pointed steadily into the wind. Meanwhile the blimp is kept from rising or dropping suddenly by counteracting its buoyancy with a sea anchor, a canvas bag that fills with 1,000 pounds of sea water when let down from the gondola. Rescued persons may climb a rope ladder to the cabin of the airship, or be hoisted aboard with rubber life rafts lowered to them. In the accompanying photographs, naval blimps and Coast Guardsmen are demonstrating the novel rescue method off Point Pleasant, N. J.



Two naval dirigibles in a test of the new sea-rescue technique. In oval, an "injured" seaman being hoisted aloft; left, dangling ladder and sea anchor

Dare-Devil Engineers Test Big Aqueduct



Start of a successful four-mile trip through Coxcomb tunnel of the Colorado River Aqueduct, to check its water capacity

In the first attempt, below, the boat sank as it pushed its way through rough water



WHEN eight gigantic pumps start forcing water over mountain ranges toward Los Angeles, Calif., through the new Colorado River Aqueduct, will the huge water system actually carry its designed capacity of 1,000,000,000 gallons of water every day? To check this theoretical capacity, a corps of engineers recently made a hazardous, four-mile journey through one of the system's tunnels, riding in a small rowboat. Measuring the water with three of the eight pumps running, they found that the water flowed at almost exactly three eighths of the tunnel's designed capacity.



Comic-Face Kit Provides Fun

COMIC caricature faces are fashioned on egg-shape pieces of wood with the materials included in a novel and inexpensive kit recently placed on the market for youngsters. The outfit includes supplies of paint and glue, a set of brushes, a pair of scissors, and a quantity of cotton wadding for making hair, mustaches, and beards.

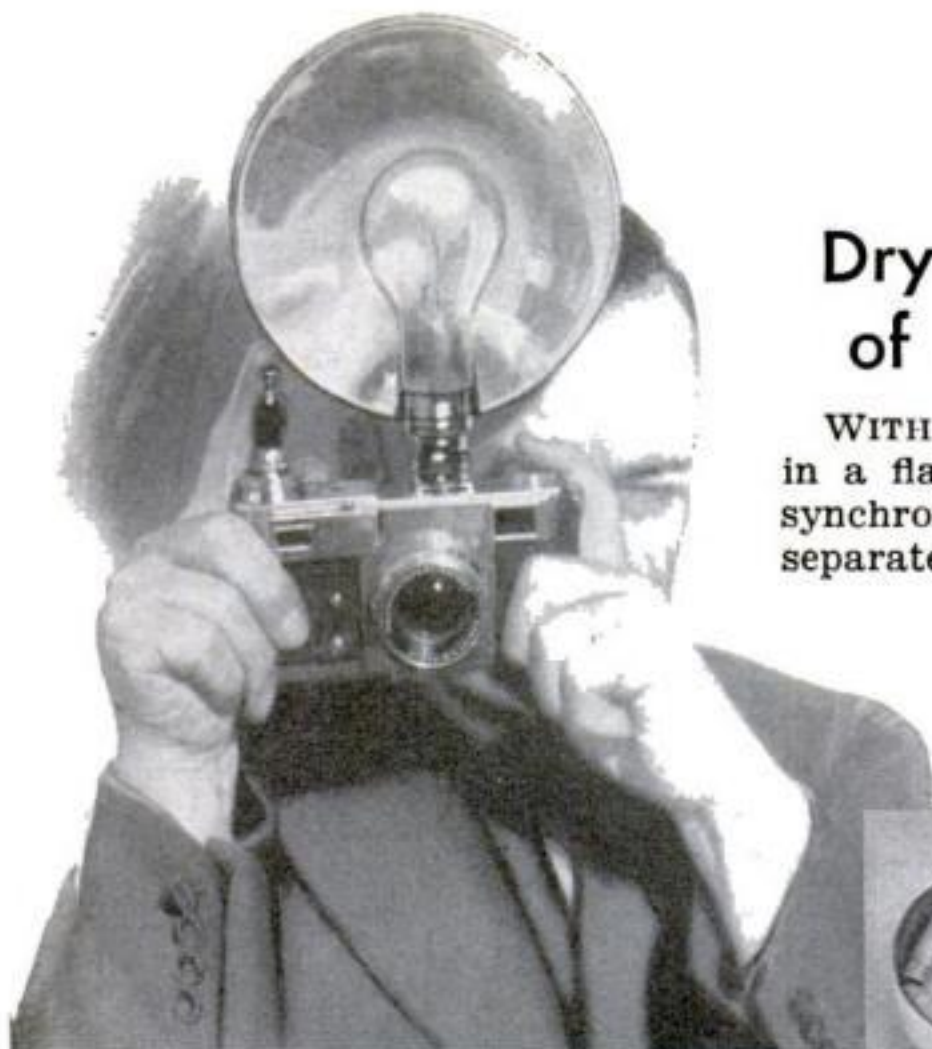
"Quake" Waves Spot Guns

A NEWLY discovered type of ground "wave" that results from earthquakes, and which is also set up by the discharge of artillery and the explosions of shells, may prove to be of wartime value in finding the positions of hidden enemy guns.

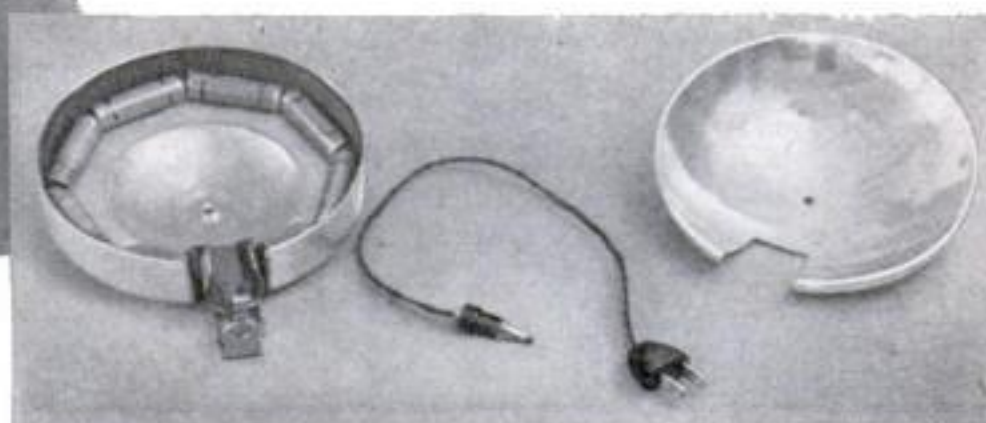
SIX NEW

Dry Cells Fit Inside Reflector of Synchronized Flash Gun

WITH six pencil-type flash-light cells neatly fitted in a flat case at the back of its reflector, a new synchronized flash gun eliminates the customary separate battery case. The tiny, adjustable synchronizer mechanism attaches to the shutter like a cable release, and is said to operate efficiently for exposures up to a thousandth of a second.



Note the absence of a separate battery box on this synchronized flash gun. Dry cells are inclosed in the back of the reflector



Darkroom Outfit for the Kitchen Door

COMBINING several important pieces of darkroom equipment in one compact outfit, a new photographer's aid soon is to be offered to amateurs with an eye to economy. The central unit is a lamp housing containing a 100-watt bulb and two safelights, one red and one green. This clamps on a folding shelf designed to be fastened to a kitchen or bathroom door. When in a vertical position with a special frame set in the top, the

housing is used as a contact printer. Turned on its side with an open-back camera fastened in place, the unit becomes an enlarger for projecting images on a folding easel furnished with the equipment. An electric switch with a third safelight built into its base is for use when making enlargements. The model to be marketed will have an easel that fastens directly to the folding shelf, instead of on a separate stand.



GETTING READY. The folding shelf on the kitchen door is lowered and the lamp house attached

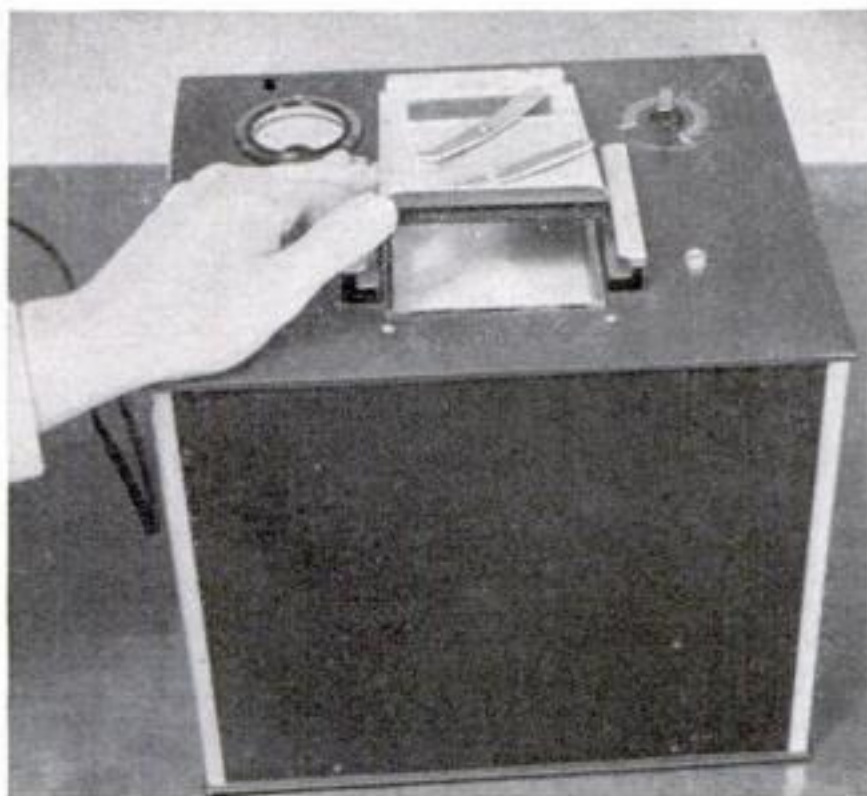


CONTACT PRINTING is done with the housing turned up and a printing frame over the opening



ENLARGING makes use of any open-back camera clamped to the housing facing the easel

PHOTOGRAPHY AIDS



Proper color rendering is assured with this printer

New Color-Photo Printer Eliminates Guesswork

SIMPLIFYING many of the problems that accompany the printing of color pictures, a new printer on the market eliminates much of the guesswork in making exposures from separation negatives. Equipped with a line-voltage indicator that visually records any fluctuation in the power supply, the device, which is shown in the illustration at the left, is easy to operate. Special filters furnished with the unit make it unnecessary to calculate individual exposure times since the same time can be used for each exposure made. By this means, the operator is certain to obtain the proper exposure to give the correct rendition of color values in the finished photograph.

Cameramen Help Produce New Enlarging Paper

WHAT qualities would you consider most valuable in a new enlarging paper? In response to this question sent by a manufacturer of photographic supplies to several thousand professional and news photographers, 1,520 answers were sent in. These were analyzed and the suggestions incorporated in a new enlarging paper just announced. The paper speeds work, reduces waste, and has wide exposure latitude.

Triple-Firing Flash Gun

MAKING three flash pictures in sequence as fast as the camera shutter is tripped is the purpose of a novel attachment now available for an automatic camera. Three sockets with reflectors mounted on a bracket which fastens to the camera are wired to the shutter mechanism.



Booklike Print Washer Is Quick and Thorough

A PRINT WASHER of odd design has fabric "pages" between which prints are placed, as though in a book. The "binding" of the book contains a perforated tube through which water is fed from a rubber hose. Standing on a special rack, the device thoroughly and quickly washes a number of prints at once.

POPULAR SCIENCE

Question Bee

There is only one correct statement in each of the paragraphs below. See if you can find it. If you get as many as sixteen of them right, you're doing well. The answers are on page 239.



- 1 Steam boilers commonly are fitted with a (a) life line (b) blow-out patch (c) check protector (d) safety valve (e) lightning arrester (f) dead man's button.
- 2 Light and heavy cruisers differ in (a) their tonnage (b) the size of their guns (c) their draft (d) the number of airplanes they can carry.
- 3 An example of a solar spectrum is a (a) total eclipse (b) sundial (c) burning glass (d) rainbow.
- 4 "Indigenous" means (a) poverty-stricken (b) colored with synthetic indigo (c) of native stock (d) nonvenomous.
- 5 You could use a blooming mill to (a) harness water power (b) roll ingots into slabs (c) manufacture artificial flowers (d) grind your breakfast coffee.
- 6 What happens when unburned gasoline explodes in a car's exhaust is called a (a) hangfire (b) misfire (c) backfire (d) spitfire.
- 7 When an amateur radio operator signals "CQ" he means (a) "Anybody answer" (b) "Merry Christmas" (c) "This station is now signing off" (d) "The static is something fierce."
- 8 Terms like "cirrus," "nimbus," and "cumulus" refer to different kinds of (a) dyes (b) stars (c) photographic film (d) rocks (e) clouds.
- 9 If you were an ancient Roman or Greek, you would use a ballista to (a) tell the time of day (b) carry water from a well (c) hurl missiles at an enemy fortress (d) find your position at sea.
- 10 A high octane rating would be desirable in (a) microscope lenses (b) gasoline (c) civil-service examinations (d) smoking tobacco (e) a diet to prevent rickets.
- 11 In the Northern Hemisphere, people see the aurora borealis; in the Southern Hemisphere, the aurora (a) australis (b) osmosis (c) hysteresis.
- 12 Boiling a liquid and then condensing its vapor is called (a) decantation (b) sublimation (c) distillation (d) filtration.
- 13 Skeet shooters use (a) howitzers (b) slingshots (c) rifles (d) bows and arrows (e) shotguns.
- 14 An example of a lighter-than-air machine is a (a) kite (b) plane (c) blimp (d) parachute.
- 15 Our nearest neighbor among the planets, at the time of its closest approach to the earth, is (a) Venus (b) Mars (c) Mercury (d) Jupiter.
- 16 You would use bromide paper for (a) taking fingerprints (b) enlarging photographs (c) catching flies (d) making carbon copies on a typewriter.
- 17 Air is (a) an element (b) a gaseous chemical compound (c) a mixture of different gases.
- 18 The longest light waves that the human eye can see produce a sensation of (a) yellow (b) green (c) ultra-violet (d) red.
- 19 Quantity of heat may be measured with a (a) thermometer (b) calorimeter (c) manometer (d) hypsometer.
- 20 St. Elmo's fire is (a) an incendiary compound once used in warfare (b) a visible electric discharge around masts and steeples (c) the principal ingredient of such fireworks as Roman candles (d) the source of light in a firefly.

Un-Natural History *By Gus Mager*



GLUTTON AMONG BIRDS IS THE **BARN OWL!** HE WILL SWALLOW MICE UNTIL THERE IS NO ROOM FOR MORE, AND THE TAIL OF THE LAST ONE DANGLES FROM HIS MOUTH!



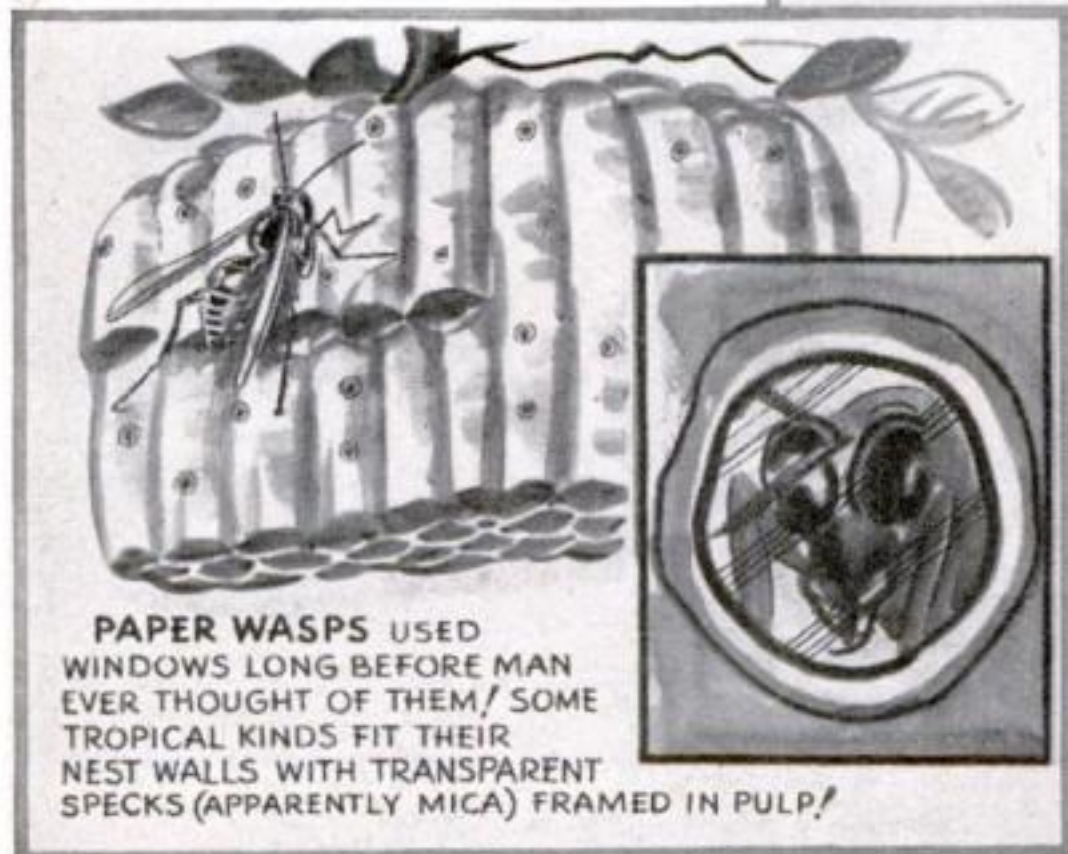
HE SPITS IN YOUR EYES, DOES THE **SPITTING COBRA!** THIS DANGEROUS AFRICAN REPTILE EJECTS A DOUBLE STREAM OF VENOM INTO ITS VICTIM'S EYES!



HOW DO **CHICKADEES** KNOW WHICH GOLDENROD GALLS CONTAIN LARVAE, AND WHICH ARE VACANT? THEY ARE SAID NEVER TO OPEN A GALL THAT HAS NO GRUB INSIDE!



THERE'S NO ACCOUNTING FOR TASTES! THE **GREAT HORNED OWL** IS VERY FOND OF SKUNK, AND OFTEN RETAINS THE ODOR AFTER BEING STUFFED FOR YEARS!



PAPER WASPS USED WINDOWS LONG BEFORE MAN EVER THOUGHT OF THEM! SOME TROPICAL KINDS FIT THEIR NEST WALLS WITH TRANSPARENT SPECKS (APPARENTLY MICA) FRAMED IN PULP!



THE **FROST FISH**, OR ATLANTIC COAST TOMCOD, CAN BE FROZEN STIFF FOR DAYS AT A TIME, THEN THAW OUT AND SWIM ABOUT AS WELL AS EVER!

Gus Licks a Jinx



Gus lighted his pipe and stood with one hand in an overalls pocket, listening to the engine

"GOOD mornin', mister." Gus Wilson looked up at the little man who had come into the shop of the Model Garage so quietly that he hadn't heard him.

"Good morning," Gus said. "Is there anything I can do for you?"

"I dunno," the little man said. "I hope you can, but I ain't bankin' on it. Say, mister—did you ever hear the story about the railroad engineer?"

"I don't think that I have," Gus admitted. "But I've heard at least a hundred that start off 'It seems there was a traveling salesman . . . ' If it's a variation of one of them—"

"Naw," the little man assured him. "It aint that kind of a story. It seems that there was a railroad engineer that had an early-mornin' run. One mornin' he gets up late, and the first thing he does is cut his face while he's shavin'. For breakfast his wife burns the bacon an' eggs an' toast, and gives him a cup of coffee that tastes like

dishwater looks. Then on his way to the roundhouse he blows a tire, has to park his car at the side of the road an' thumb a ride, an' shows up so late his boss gives him hell. But he gets started on time, and after a while he gets his train out on the main line. Pretty soon he heads 'round a curve—and what does he see but an express train comin' around the curve from the opposite direction, doin' a good sixty, an' *on the same track he's on*. So he looks over at his fireman an' says: 'Jim', he says, 'this is one of them mornin's when everything goes wrong.'"

Gus Wilson is a polite man. He laughed. Then he said: "That's a good story—but you're not a railroad engineer, are you?"

"Naw, I ain't," the little man admitted. "I drive a truck and my name is Hornsby. I ain't had any head-on collisions with express trains—so far. But this is one of them mornin's when everything goes wrong."

"We all have them," Gus said. "What's been going wrong with you?"

Hornsby produced a big black cigar from under his windbreaker and fired up. "I live fifty miles up-state from here, an' drive a truck for a factory that makes a line of mechanical do-funnies," he explained. "This mornin' I had a rush delivery to make down in the city, so I got rollin' a few minutes after seven. Went along all right for maybe ten miles—an' then we stopped. Don't ask me why. Never had any trouble with that truck before—less'n fifteen thousand on its clock. I tried everything I knew, and after quite a while I got started again. Couldn't figger out why, any more than I could figger out why we stopped. Had to stay in low or in second, an' the engine kept sputterin' and missin' all the time, but I managed to keep movin' until we got to a garage in the next town.

THE feller in the garage goes all over everything, and then says the trouble is caused by pitted distributor points. 'Put in new ones,' I says, 'an' charge it to the firm.' He puts in new points, an' the bus runs fine—until we get out of town. Then she starts buckin' and backfirin' again, an' I have to keep her in low until we get to the next garage.

"The mechanic there goes over everything, and says the trouble is that the carburetor is dirty. 'Clean it out,' I tells him, 'an' charge it to the firm.' So he cleans out the carburetor, and I start off again. Same thing. We go along fine until we get out of town, and then the engine starts actin' up again. So I have to go back into low again, with the engine actin' like it was starved for gas.

"After while I gets to another garage, and drives in. The feller checks everything, says there's nothin' the matter with the gas line, and that what I need is new spark plugs. 'Put 'em in,' I tells him, 'an' charge it to the firm. He says: 'Nothin' doin'. No credick—can't you read the sign? But I tell you what I'll do—I'll put new plugs in, an' if they don't make your truck run all right I won't take your money'. I had a few dollars in my pocket, so I told him to go ahead. When he gets the new plugs in the engine runs smooth as cream. So I pays him—an' no sooner we're out of town than that danged truck quits on me again!

"This time it takes me fifteen minutes to get started. Then we come to a detour ten miles up the road, and I says to myself: "This washboard road'll stop you for good. So I starts over the detour—and the bumpier the road gets the better the truck runs. Sometimes I even get into high for a half mile or so. But soon as we get back on the concrete—bam! Back into low, with the engine coughin' and sputterin'. F'ix her up,

mister—if you can. But I ain't got any more cash on me, so you'll have to charge it to the firm."

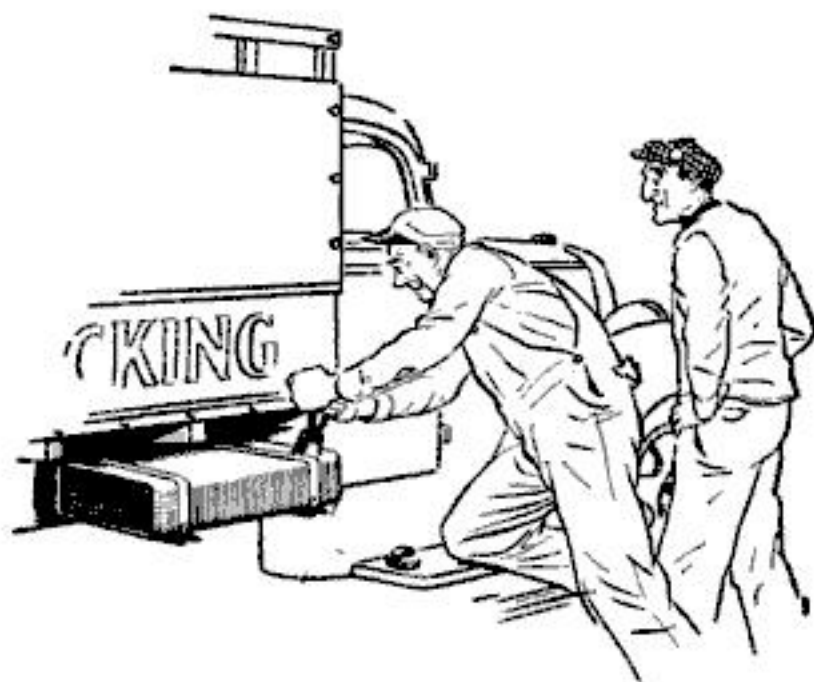
"Never mind about the cash," Gus told him. "Drive your truck in and I'll have a look at it."

"If she'll start," Hornsby said gloomily. But half a minute later he drove into the shop with his engine running smoothly. "It ain't the wiring, an' it ain't the gas line, an' it ain't the carburetor, an' it ain't the plugs—they've all been checked," he said. "You got a job on your hands, mister!"

Gus didn't seem to be in any great hurry to start on the job. He lighted his pipe and stood with his hands in his overalls pockets listening to the engine. "She idles all right," he observed. "Now open the throttle—as far as if you were driving at about thirty miles an hour."

After a couple of minutes the engine began to miss. Then it stopped.

"Switch it off," Gus said. He stood looking at the gasoline tank—a square tank with the



He inserted two long screw-driver blades through the filler and caught the plate

**Everything Seemed To Be
Going Wrong for Hornsby
Until He Got His Balky
Truck into the Hands of
Gus at the Model Garage**

• • •

BY MARTIN BUNN

fuel pipe running at an angle down from its bottom, directly in line with the filler cap.

"Can't be the tank," Hornsby said. "I thought of that, but the whole gas line's been checked three times."

Gus unscrewed the filler cap. "No harm in having a look," he observed as he peered into the tank. "Say—what sort of tank is this, anyhow?"

He moved aside, and Hornsby looked into the tank. "I don't see anything any different from any other tank about it," he said.

"You don't, hey?" Gus came back at him. "Well, I do. It's the first gas tank I've ever seen that didn't have any way for the gas to get out of it."

HORNSBY looked again. The bottom of the tank was a smooth sheet of galvanized metal, with no hole where the fuel-line pipe was attached to the bottom. "By Jimmy," the little man said, "that's the hottest one I've ever heard of!"

Gus brought a flash light from his workbench and turned its beam into the tank. Then, looking through the filler from as wide an angle as possible, he saw that what had seemed to be the bottom of the tank really was a foot-square piece of sheet metal lying on the tank's bottom.

"There's the cause of all your grief," he told Hornsby. "Nothin' more serious or mysterious than a splash plate that has come unsoldered and fallen across the gasoline outlet. Naturally, it shut off the flow of gas, and your engine couldn't run properly."

"Yeah?" Hornsby's tone was doubting. "Maybe you're right, mister, but it sounds sort of screwy to me. If it wasn't gettin' gas, how come the engine would run all right for a while before it quit on me, right after I'd come out of a garage? An' how come that it ran real good on that stretch of washboard road, and then darned near went dead soon as I got back on the pavement?"

"I'll tell you just what happened," Gus said. "The splash plate broke loose after you had driven a few miles this morning, and fell over the fuel-pipe outlet. After a few minutes the suction of the fuel pump drew it down over the opening so tightly that no gas, or at most only a mighty little gas, could get into the fuel line. So after the gasoline in the carburetor had been used up, your engine stopped. When the engine stopped the fuel pump stopped working, so there was no more suction, and the plate loosened enough to allow a little gas to run under it into the fuel pipe. Then when you started the engine again, the pump drew a small amount of gas into the carburetor before the suction clamped the plate down tight again, and the engine ran on that gas until it was used up—and then you were

parked right behind the eight ball again.

"Pretty much the same thing happened each time that you stopped at a garage. I'm not saying that the mechanics who worked on the job shouldn't have found the cause of your trouble—but they were looking for something else, so they didn't find it. What put me on the right track was what you told me about your engine running better on that stretch of washboard road. That gave me the idea that there might be some obstruction in your tank that was cutting off the gas, and that the jouncing that your truck got on the rough road had loosened it temporarily."

"Well," Hornsby said, "you're the doctor. Get me fixed up quick, will you? I've got a rush delivery to make, an' I'm hours late on it now. Say, how the heck you goin' to get that splash plate outa the tank? That's a job for Houdini!"

"And I'm no Houdini," Gus admitted. "I'll have to cut the tank open to get it out, and that'll take time. . . . But wait a minute. I think I know how I can fix it so that I won't have to take the plate out."

He took two long screw drivers, inserted their blades through the filler, and after several failures succeeded in getting the sides of the plate between the ends of the blades and exerting sufficient forces to bend the middle of the plate upward, so that it no longer could lie flat on the bottom of the tank and shut off the flow of gasoline.

"That will fix you up temporarily," he told Hornsby. "I doubt if that splash plate ever will make any more trouble, but to be on the safe side maybe when you get home you'd better have the tank opened and the plate soldered back where it belongs."

"Thanks, mister," the little man said. "Have a seegar? Don't smoke 'em, hey? Well, charge the job up to the firm. You're a good trouble-shooter, I'll tell the world!"

AS THE truck rolled away, Joe Clark called to his partner from the shop door.

"Say, Gus, Mrs. Miller's been on the phone a couple of times already to ask whether you're going to have her car ready by noon, the way you promised. She wants me to call her back. What can I tell her?"

Gus stared at Mrs. Miller's car, on which he had been working when Hornsby had driven in with his load of grief. "Gosh," he exclaimed, "I'd forgotten all about that darned job! And I held it over until this morning because I thought I'd have plenty of time!"

"Yeah," said Joe. "But what'll I tell her?"

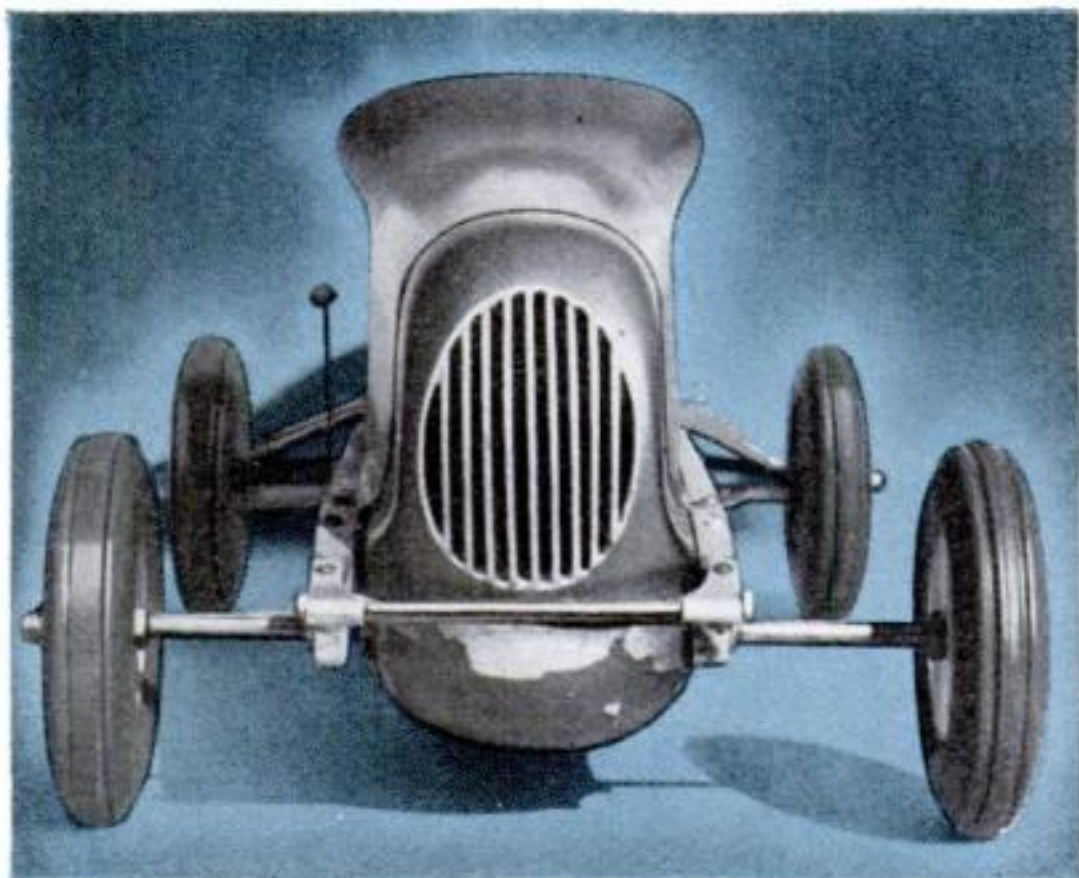
Gus glanced at the clock. "You tell her that her bus will be ready at noon, as promised! Say, Joe, did you ever hear the story about the railroad engineer who . . ."

THE HOME WORKSHOP



In This Issue.. GARDEN MARKERS • SHOP MACHINES
MIDGET RACER • RADIO • SHIPSHAPE HOME

HOW TO BUILD A *Superspeed*

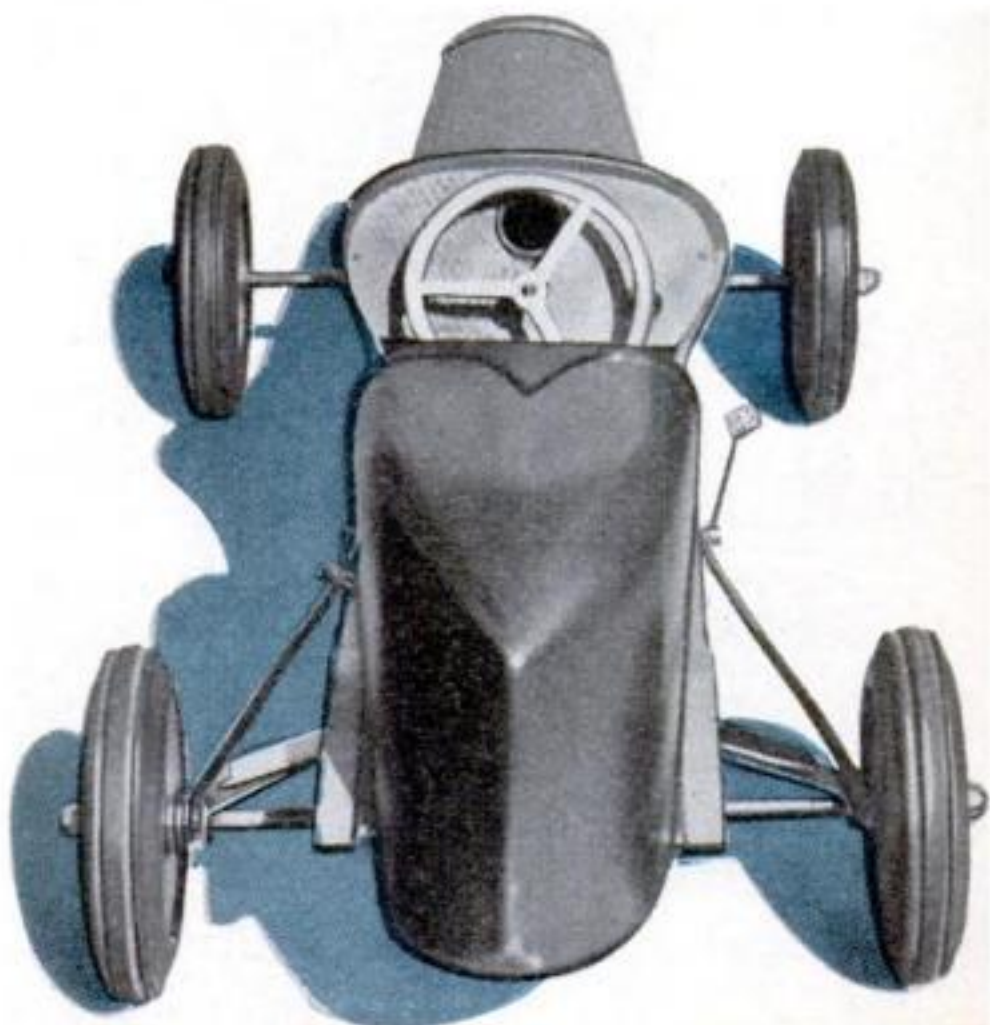


CLOCKED AT 56.2 MILES AN HOUR IN TRIAL RUNS, THIS NEW "TINY TORNADO" IS A CAR OF CHAMPIONSHIP TYPE

IF YOU want to reach top rank in midget auto racing and perhaps hang up a record, here is an incredibly fast, trim, and dependable design to follow—the "Tiny Tornado." In trial runs it has been clocked at 56.2 miles an hour.

The overall dimensions of the car are 20 $\frac{3}{4}$ " long, 9 $\frac{3}{4}$ " wide, and 7 $\frac{1}{4}$ " high. It weighs 5 $\frac{1}{2}$ lb., and is powered with a popular commercial engine developing $\frac{1}{4}$ h.p. at 8,000 r. p. m. A front-wheel friction drive of a simple and easily adjusted type is used, and the power ratio is 1.5 to 1.

No matter what type of racer you wish to build, you will find it worth while to study this design. For example, if you intend to use a construction kit that is complete ex-



Midget Racer

cept for the body, you can build a body to suit by following the method illustrated. On the other hand, if you are a capable craftsman, you can construct everything but the engine and its accessories. You can even build the wheels, although excellent wheels, of course, can be purchased. Even if you do not include all possible refinements, such as needle-roller bearings, you can still duplicate the general plan and have a midget that is likely to win distinction on any local track.

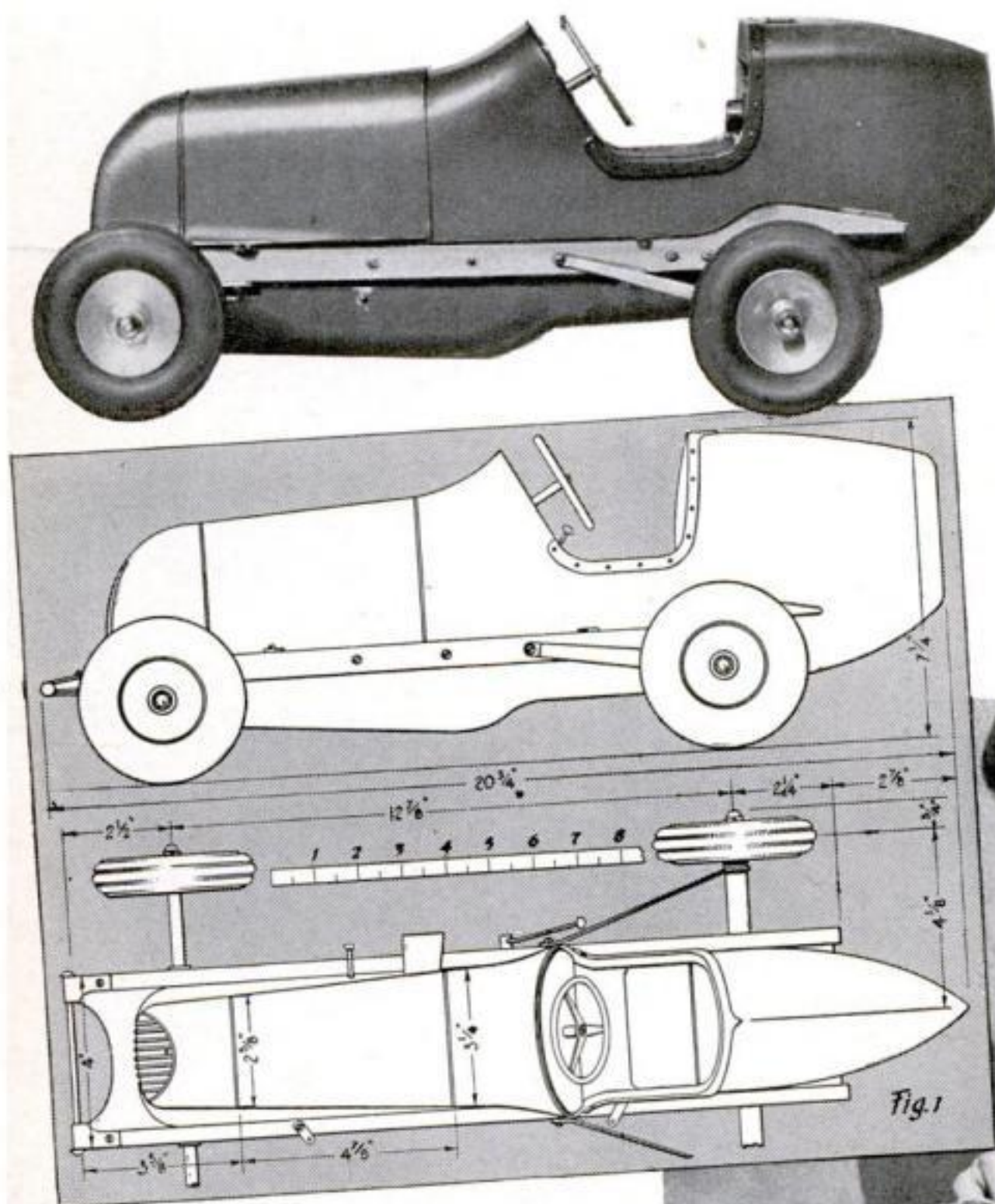
The "Tiny Tornado" is the latest model built by Gordon Babb, of Pasadena, Calif., a veteran model enthusiast. He credits much of its speed to the wheels, which he designed and made himself.

The clean-cut lines of the midget are apparent in the photographs as well as in the side and top assembly views, Fig. 1. The racer conforms throughout to standard regulations for official contests. Any front-drive motor of standard midget-racing type can be used by adapting the chassis to suit. The

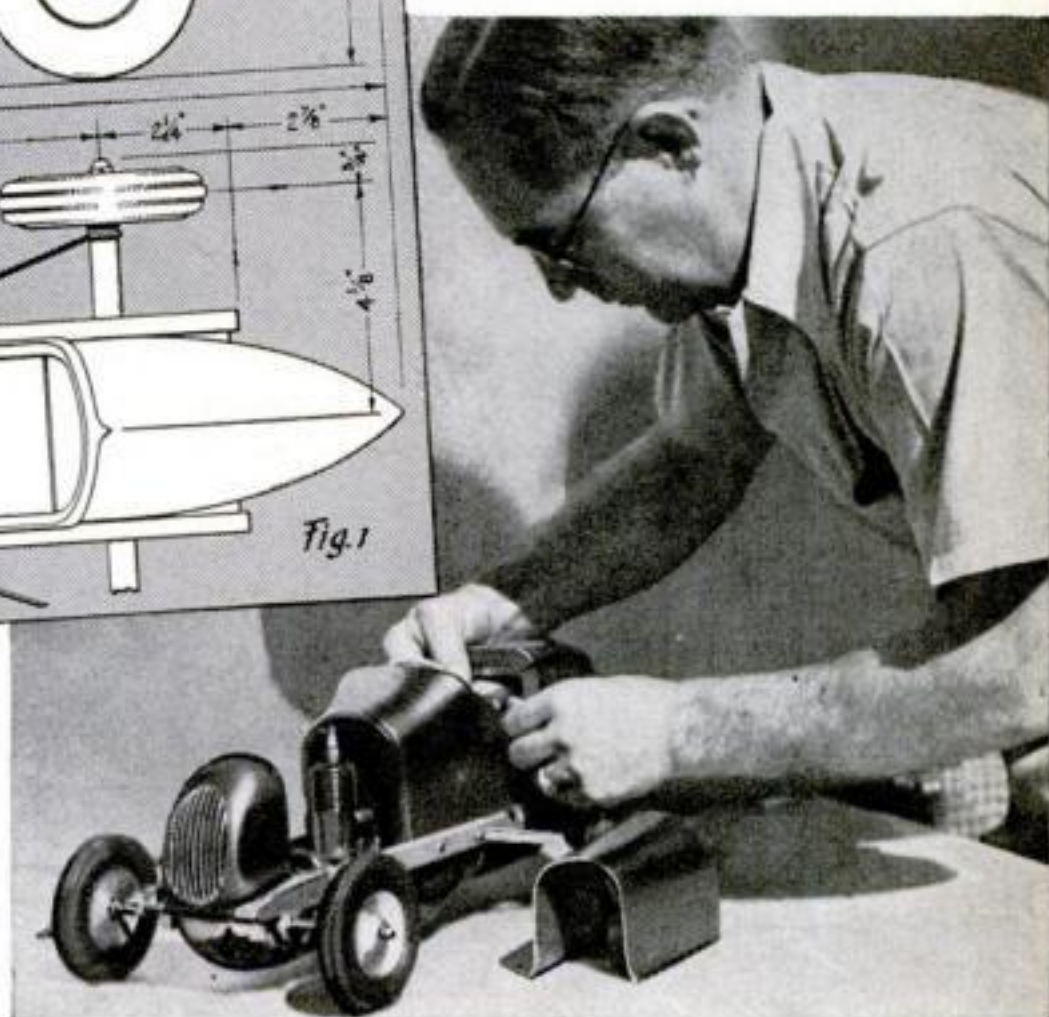
best plan is to select your motor first and build the chassis accordingly. You will find very little alteration is necessary for several different engines.

Begin with the chassis frame, Fig. 2. This is of maple, very simple but sturdy in construction. It is assembled with casein glue and screws.

Next rough out the balsa pieces that form the body. Patterns are given in the squared profiles, Fig. 3. They are laid out in sizes suitable for stock balsa. Note that the radiator shell A is assembled in halves and fastened with

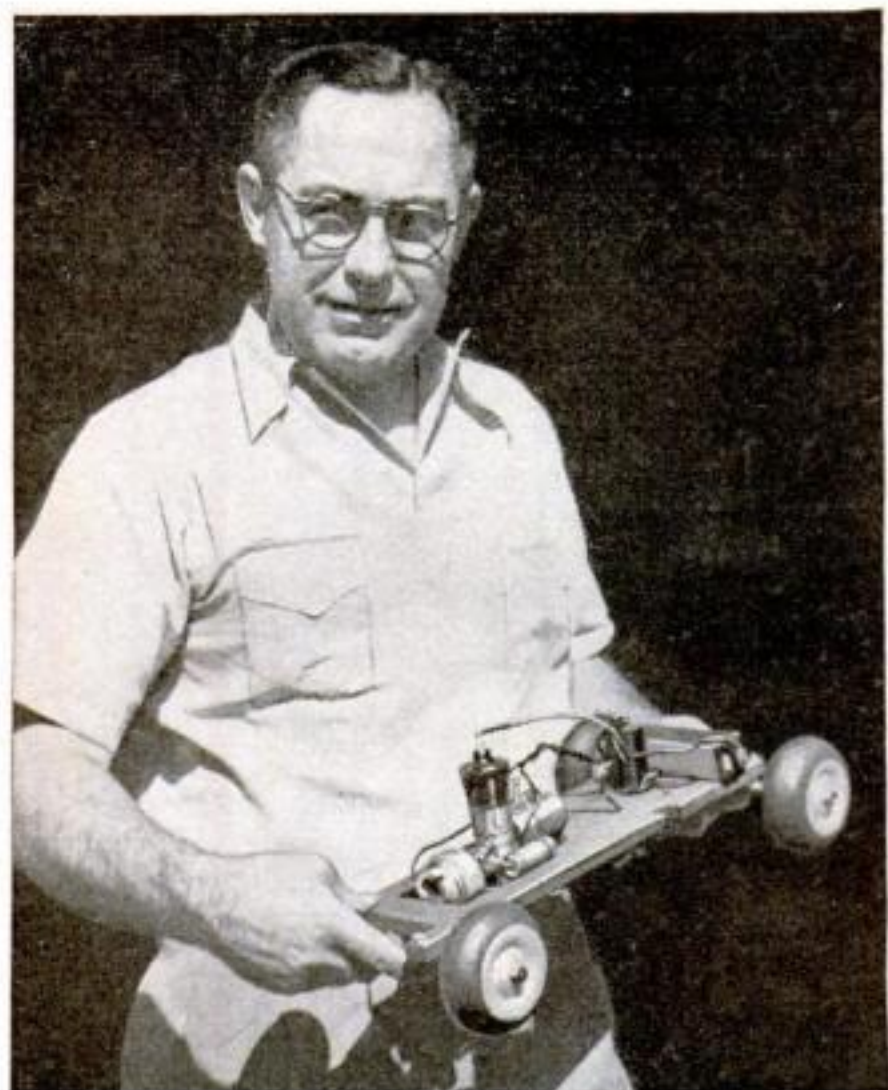


Clean-cut lines and almost perfect balance are found in this midget. Right, installing the tiny battery



By HI SIBLEY

MARCH, 1940

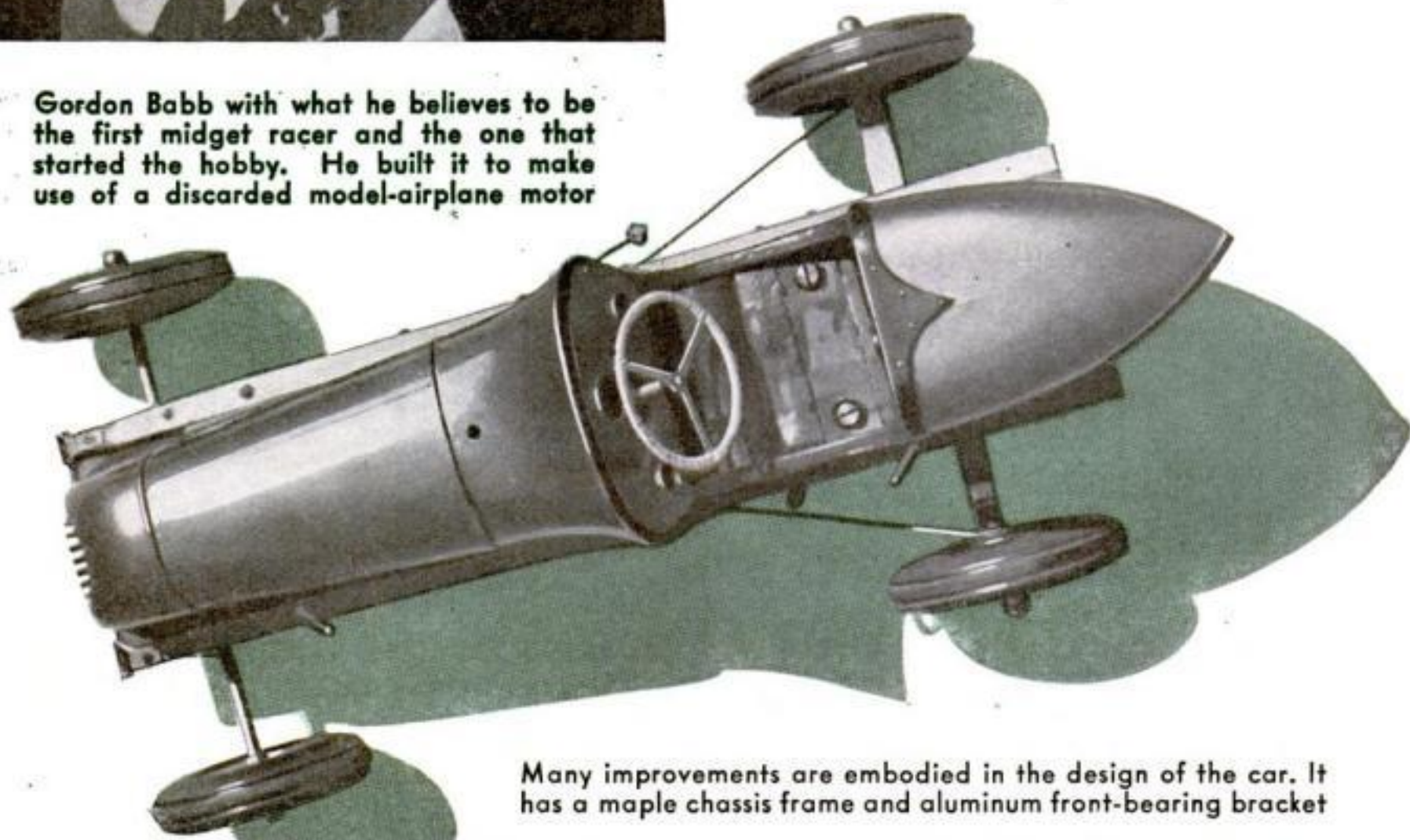


Gordon Babb with what he believes to be the first midget racer and the one that started the hobby. He built it to make use of a discarded model-airplane motor

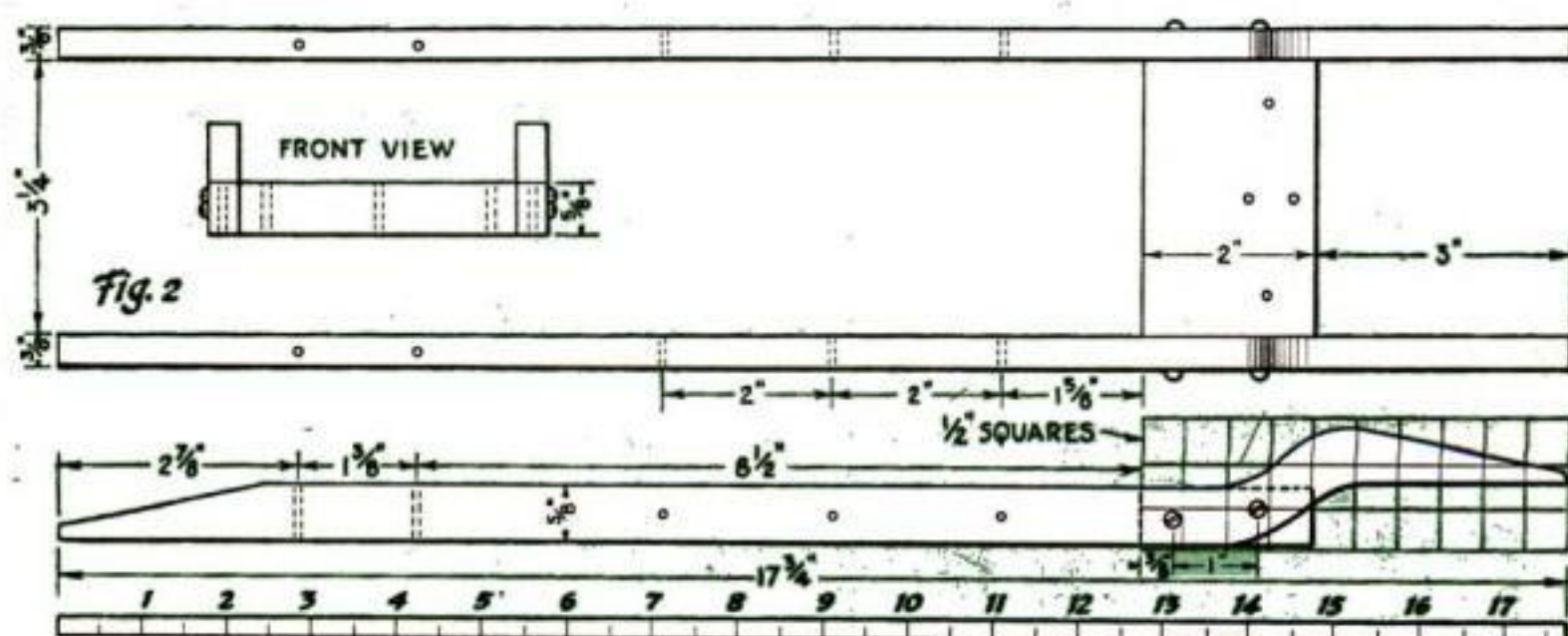
airplane cement along the middle. In cutting out all these pieces (except the plywood), allow a little extra for trimming. Figure 4 shows the relative positions of the various pieces, all drawn to scale, and the perspective view in Fig. 5 illustrates the body when cemented together in the rough.

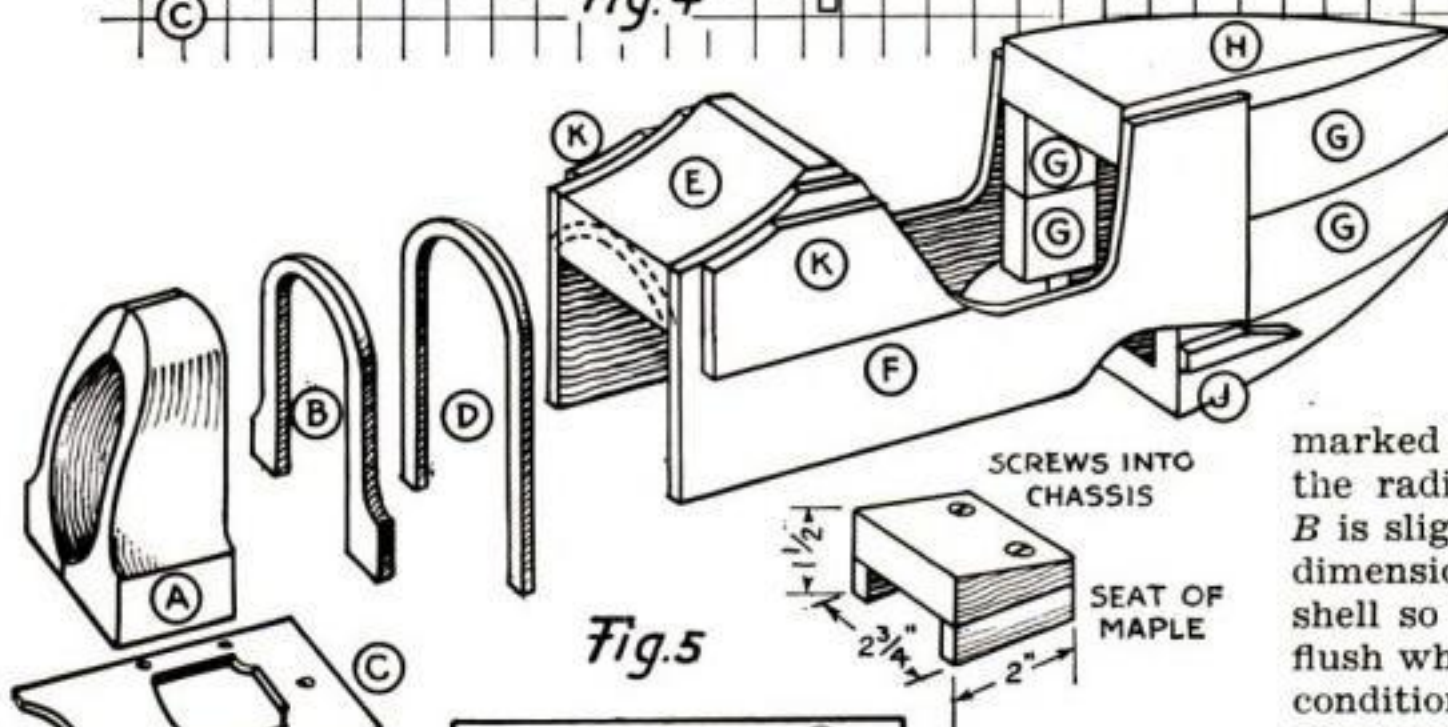
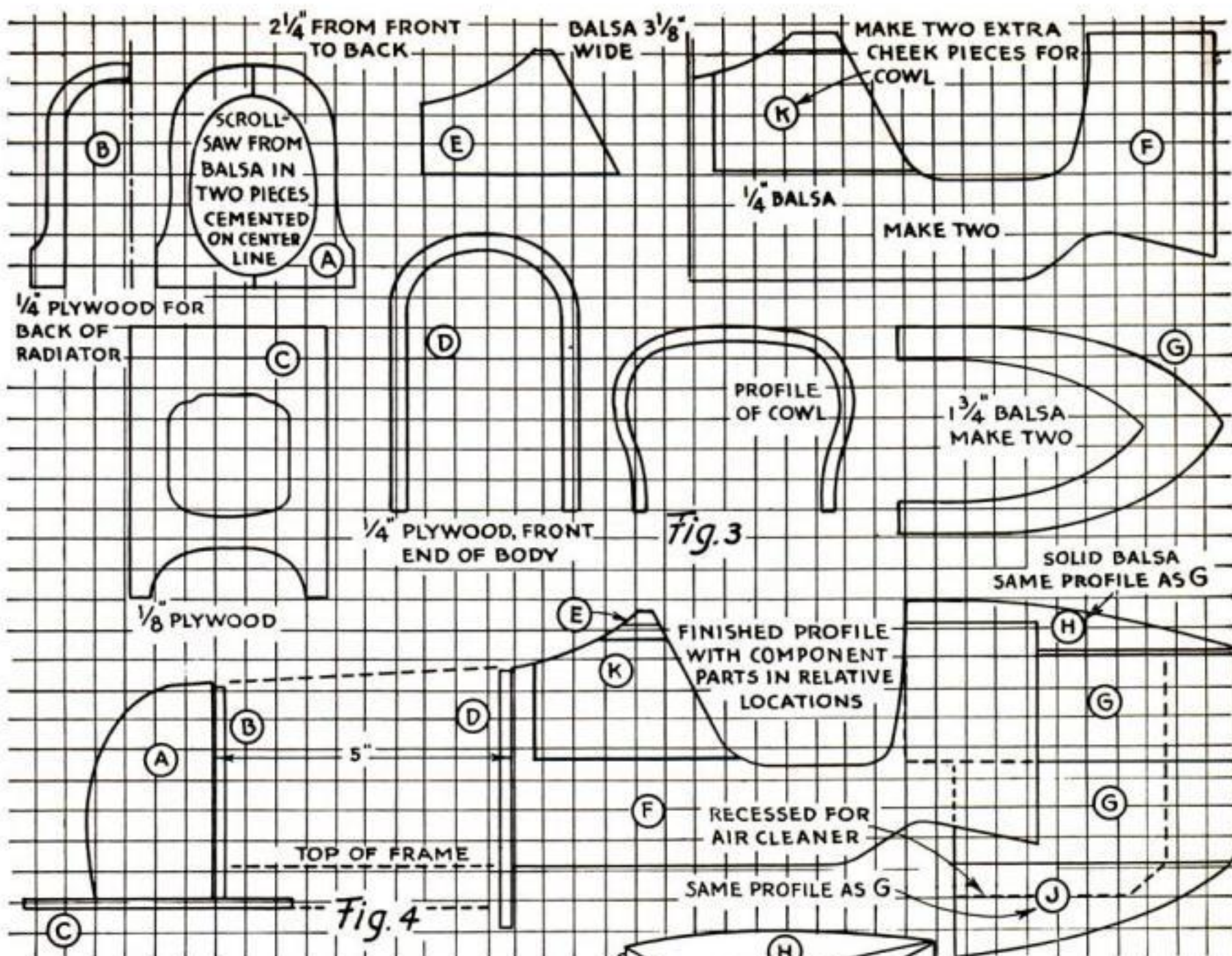
Note the cheek pieces *K, K*, which give the greater width required at the flare of the cowl. There is an added strip on the side of *J*, which is also of balsa. It is against this that the rear end of the side frame rests. The bottom piece *J* is recessed to accommodate the air cleaner to be installed later. The plywood piece *D* is cemented to the front end of the body, and *B* to the back of the radiator shell. Figure 6 shows a section of the cowl with the location of various pieces.

A typical racing-style radiator is illustrated in Fig. 7, with a grille of thin balsa pieces cemented in as indicated. You can easily see how the inverted U of plywood



Many improvements are embodied in the design of the car. It has a maple chassis frame and aluminum front-bearing bracket



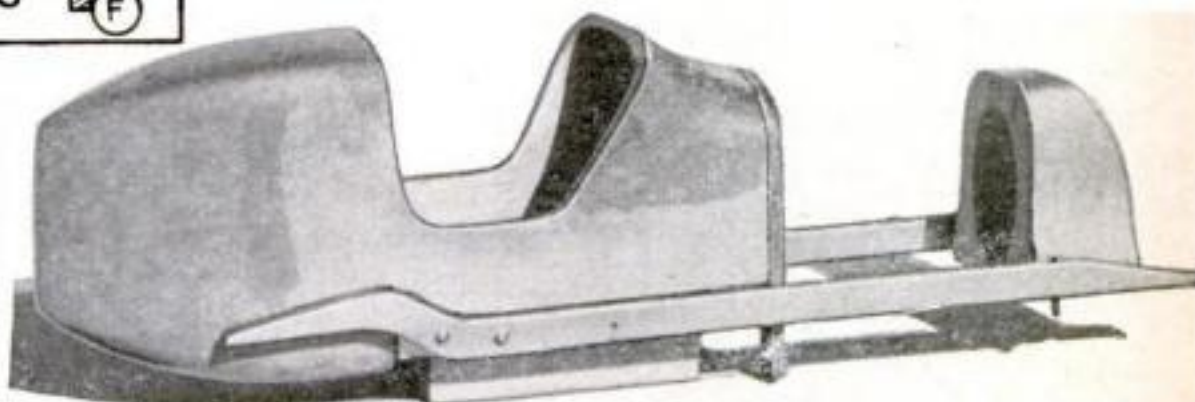
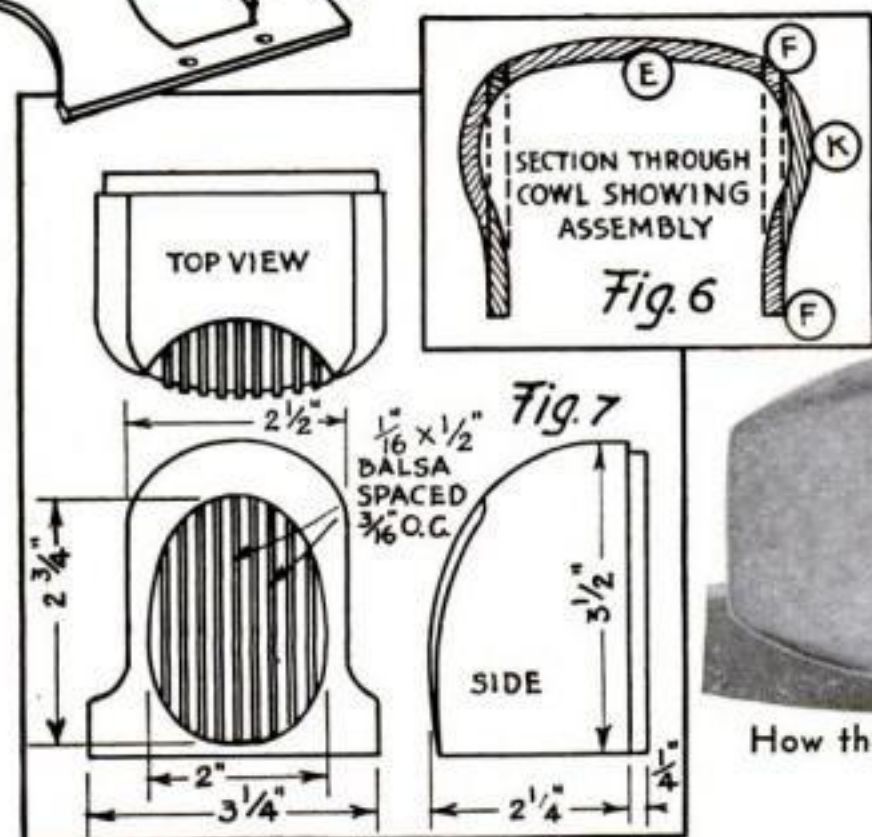


The drawings of the body parts (Figs. 3, 4, 6, and 7), as well as the chassis frame, are shown quarter size

marked B is set on the back of the radiator shell. This piece B is slightly smaller in outside dimensions than the radiator shell so that the hood will set flush when in place. The same condition also applies to D.

The radiator shell is, when completed, cemented to the plywood piece C, which fits in between the frame members. The seat is of sturdy construction (Fig. 5), and screws pass through it to the chassis.

(TO BE CONTINUED)



How the maple frame and balsa-wood body appear in the rough

Eyepiece Turret for Telescope

MADE FROM
TWO KITCHEN LADLES
AND SHEET METAL



By L. C.
Peltier

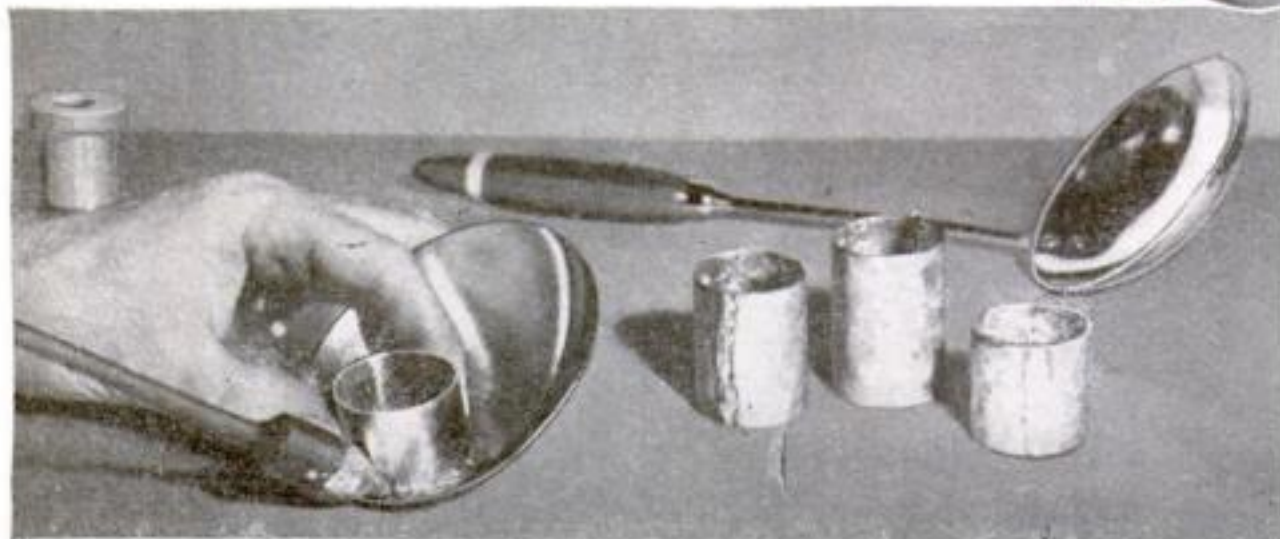
AS EVERY amateur telescopist knows, several eyepieces are necessary if one wishes to see the various celestial objects at their very best, yet the task of changing from one eyepiece to another is annoying unless one employs some form of turret. The writer has for years used a homemade turret made from nothing more pretentious than a couple of ladles and a few scrap pieces of sheet metal.

The handles are removed from the ladles, and the bowls, when nested, should rotate smoothly. Holes $\frac{3}{16}$ " in diameter are drilled through the exact center of each. At a suitable distance from the center hole—depending on the eyepiece diameter—holes are drilled for the eyepiece tubes



and for the tube that fits into the focusing tube of the telescope. The latter tube should have its seam soldered on the inside and must fit very tightly in the telescope tube. The eyepiece tubes, which are soldered over the holes cut for them in the outer bowl, have their seams soldered on the outside. The length of these tubes should vary with the focal length of the eyepieces used in them.

A $\frac{3}{16}$ " stove bolt fits tightly in the center holes and thus acts as a pivot. The surfaces in contact should be covered with a film of grease, while the exposed surfaces may be buffed to a polish and protected with a coat of clear lacquer.



How the parts are assembled. Mr. Peltier, shown using the turret at the top of the page, is one of the foremost amateur astronomers

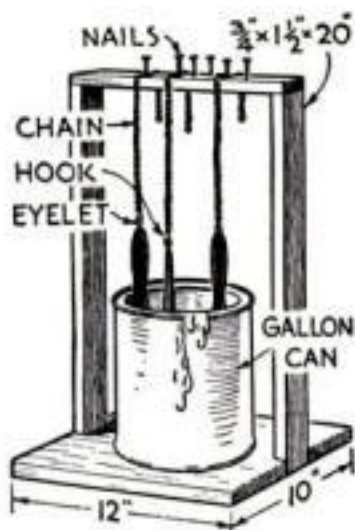
Gay Memo Pad Brightens Kitchen

THOUGH easily built, this gay bird is definitely in the "fine feather" class as it stands guard over a kitchen memo pad. The body is cut from $\frac{3}{8}$ " pine. Before smoothing the edges, glue the finished forehead in place. Note that the forehead recedes slightly.

From $\frac{1}{4}$ " pine, cut the $3\frac{1}{8}$ " by $5\frac{1}{4}$ " rectangle that forms the backing for the paper pad. In gluing this piece, leave a $\frac{1}{8}$ " slot between its rounded top edge and the body. At the bottom edge of the backing, glue an L-shaped strip. To make this, simply cut a groove with a handsaw in a strip about $\frac{1}{2}$ " thick, then plane down to the cut on one side and glue the piece in position. When set, trim to $\frac{1}{8}$ " thickness. Fasten the winking eye with glue. Now enamel this much of the work red, and at the same time enamel a wooden pencil to match.

Four $1\frac{1}{4}$ " diameter disks are next turned on the lathe faceplate. One of these is $\frac{3}{8}$ " thick and serves for the inner part of both feet after being tapered by hand as shown. The other three disks are $\frac{1}{8}$ " thick. Mark the circle on the eye before removing the disk from the faceplate. Roughen the enamel where the eye and feet are glued to body. Standard size 3" by 5" paper pads are available at any dime store, and are inserted as shown.—THEODORE TORRISON.

The body is cut from $\frac{3}{8}$ " pine and enameled red



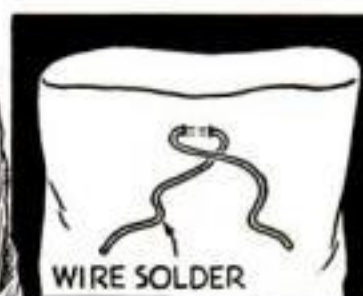
Nails adjust chains to desired lengths

Chains Suspend Brushes in Liquid "Keeper"

PAINTBRUSHES of assorted sizes can be kept immersed to the proper depth in a suitable brush-keeping solution, such as turpentine and linseed oil, by suspending them with chains from a frame made as shown. This method allows for evaporation of the solution. All the attention the brushes require is an occasional adjustment of the length of chain. An eyelet is screwed into the end of each brush handle so that the brush is easily detached from the hook on the chain when it is needed.—R. E.

Stock-Food Sacks Tied With Wire Solder

THE annoyance of tying and untying twine fasteners on sacks of poultry or stock foods caused one farmer to substitute short lengths of wire solder for the usual strings. These are stitched through the sack as shown below to hold them in place and are always ready for use.—G. E. H.



Two or three turns of wire around the sack close it securely



Inner-tube rubber is stretched over the top of the keg

African Tom-Tom Made from Old Nail Keg

AN AFRICAN tom-tom made from a nail keg and a piece of old inner tube will add much fun and pleasure to a party or outing. Remove the iron band from the open end of the keg, stretch the inner tube over the top as tightly as possible, and make it fast with a few tacks. The iron band is then replaced and held with small nails about 2" apart. The surplus rubber is trimmed around the lower edge of the band, and the body of the keg painted in any gay colors desired.—CHARLES HOMEWOOD.



Name Set into Door Mat by Using Marbles

A NOVEL door-mat sign can be made by inserting glass marbles of suitable size into the openings of a wire mat of the type illustrated above. The stunt is useful for the entrances to inns, restaurants, and other business places. The mat shown is from an inn near Petoskey, Mich.—W. B.

Narrow Friction Tape Forms Neat Joints

AMATEUR electricians usually can tape a spliced joint with greater neatness if the friction tape is first torn into strips half as wide as usual. Not only are the narrower pieces easier to apply, but the covering is likely to be tighter and the joint much less bulky.—W. K.



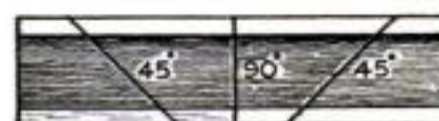
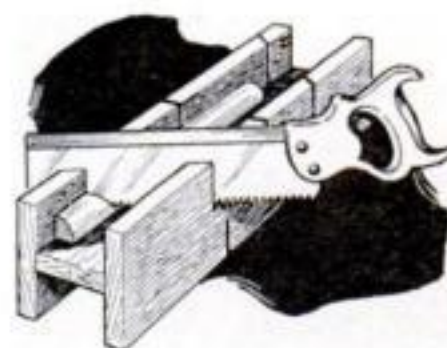
If torn in half lengthwise, friction tape is easier to apply over spliced joints in wires

Models Rubbed to Dull Finish with an Old Toothbrush

TO GIVE a dull finish to the surface of ship-model fittings, railway cars, or accessories, rub down the painted, enameled, or varnished surfaces with an old toothbrush dipped in fine powdered pumice stone. The rubbing may be done dry for a very dull finish, otherwise dip the brush first into water or oil.—GEORGE W. NIEDERMAIR.

Double Miter Box Gives Variety of Cuts

SHAPED like an I-beam but made of wood, this double miter box has the advantage of combining a large number of cuts with light weight and compactness. One side has the usual 90- and 45-deg. cuts; the other, any special cuts required such as 60- and 30-deg. angles.—N. W.

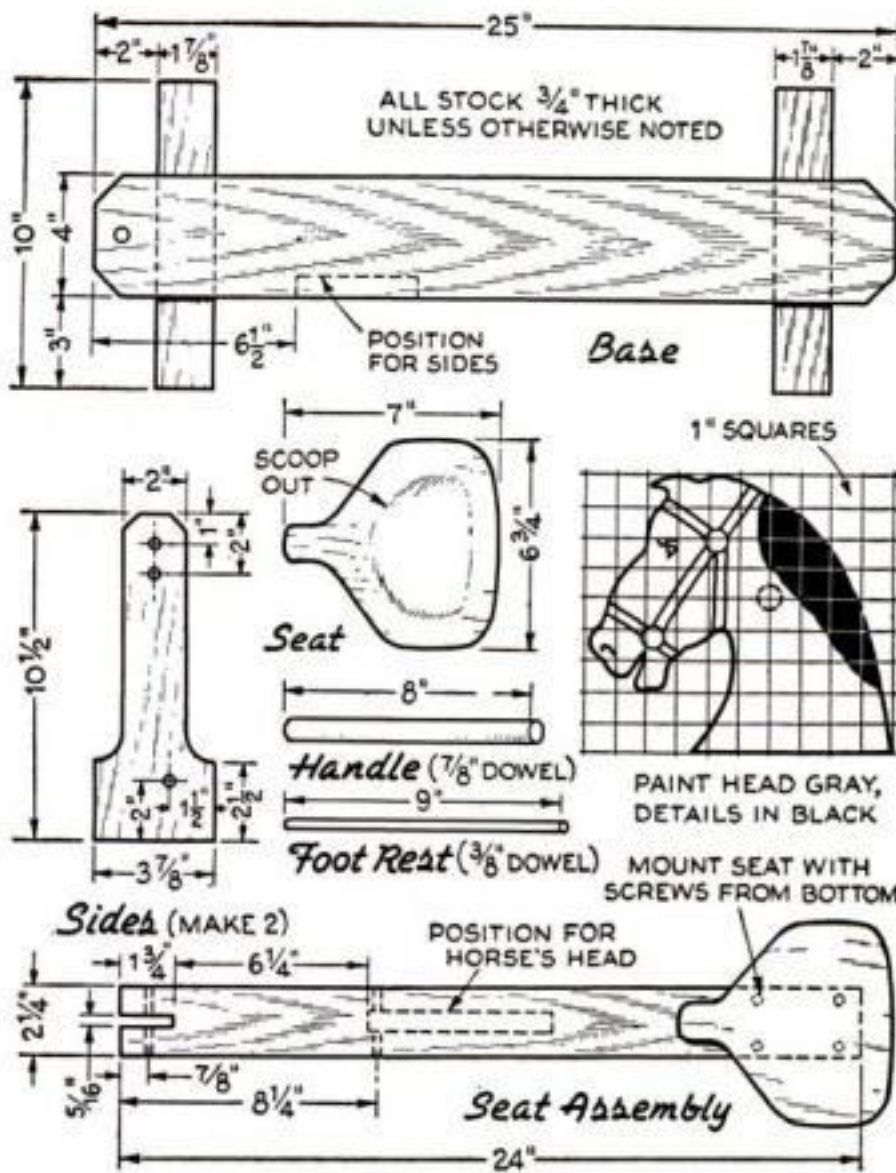


ONE SIDE HAS 90° AND RIGHT AND LEFT 45° CUTS



OTHER SIDE 60° AND 30°

Muscle-Building Bronco Toy Thrills Small Children



CHILDREN up to four years of age can get lots of fun and exercise with this bucking-bronco toy. Make the parts as shown and assemble with screws from the bottom up so they do not show. The 9" length of $\frac{3}{8}$ " dowel used for the foot rest should extend equally on each side and be

glued in. The handle is a thicker piece glued securely in a hole in the horse's head. Bevel or sand all edges except the bottom of the legs. Attach the top board between the side panels with a bolt.

The spring, which can be obtained at almost any large hardware store, is attached to the baseboard with an eyebolt and at the top with a bolt through the front end of the seat assembly, which is cut out to allow for the upper loop of the spring.

A good color combination is red with the horse's head in gray and details in black. The inside of the mouth and the handle are red; spring and bolts, black.—J. A. KLOSTER.

Phone Book Read Through a Pinhole

IF YOU find it difficult to read tiny print, as in a telephone directory, carry a small piece of black paper with a small hole in it about the diameter of a darning needle. By holding the paper close to one eye and looking through the hole (provided your eyes are not too bad), you will see the print quite clearly, as if magnified. This makes the reading much easier, especially in a poorly lighted booth.



Rubber Holder Adjusts a Drop Cord

IN THE darkroom or shop, lamp cords frequently need to be adjusted. For this, an ordinary rubber wedge-type broom holder will be found handy. The holder is fastened in the most convenient position, and the lamp cord is merely pushed between the two flexible gripping surfaces as shown. The attachment will support the socket and bulb firmly, yet no damage will be done to the insulation.



New Cabinets Modernize



Tile-topped cabinets on both sides of the basin are very useful additions

ALMOST any old-fashioned bathroom, if of reasonable size, may be improved and modernized by rebuilding the cabinets or putting new ones in corners now idle. Perhaps the most striking of modern bathroom cabinets is the so-called "Pullman" lavatory, in which the washbowl is flanked with a tile-topped case at one or both sides. If there is a foot or two of clearance at the sides, such a chest can be constructed around an old roll-edge lavatory by the method shown in the drawings.

Locate the inner faces of the cabinet sides with plumb lines on the wall, and mark level lines for the top and the shelf cleats, which are nailed to studs. Draw a line on the floor for the front, and square back from this for the sides instead of squaring out from the baseboard, which might not be straight. Plan the depth of the cabinet to be $1\frac{1}{2}$ " less than the projection of the washbowl.

After the sides are glued up, scribe them to the wall, cut the tops off level, and nail on the cleats.

When the sides have been nailed to the wall cleats and the floor, brace them with diagonal strips across the top. Install the shelves, glue and nail the stiles, and complete the frame with rails and drawer guides. Then fit the lavatory apron.

Sheath the top with rough lumber cut to project $\frac{3}{8}$ " at sides and front. For a finish, nail a $\frac{3}{8}$ " strip beneath. This may be left square on the lower edge or molded, as desired. A second strip nailed over this hides the top edge and, projecting $\frac{3}{8}$ " above, gives a good mortar bed for the tile. If a wooden baseboard is to be used, miter this around also. In many cases a tile base gives the best appearance.

Use either flush or lip doors and drawers. Five-ply stock of $\frac{3}{4}$ " thickness makes excellent flat doors if (when lipped) the edges are well puttied where the molding operation tears the cross grain. Should flush

doors be used, have hanging stiles and rails $\frac{1}{16}$ " thicker, thus allowing for the paint and a working clearance between doors and shelves. Also project the lower shelf $\frac{3}{8}$ " above the lower rail for a bottom stop.

Flat-edge lavatories

Steps in converting an old washbowl into a so-called "Pullman" lavatory. The dimensions marked "a" and "b" should not be made the same



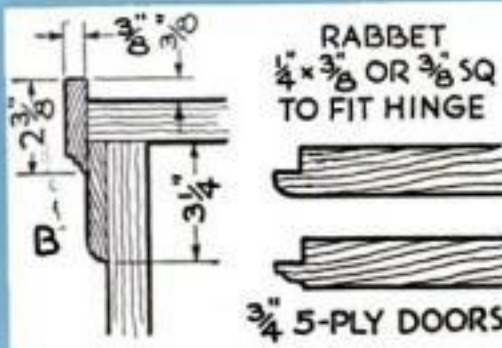
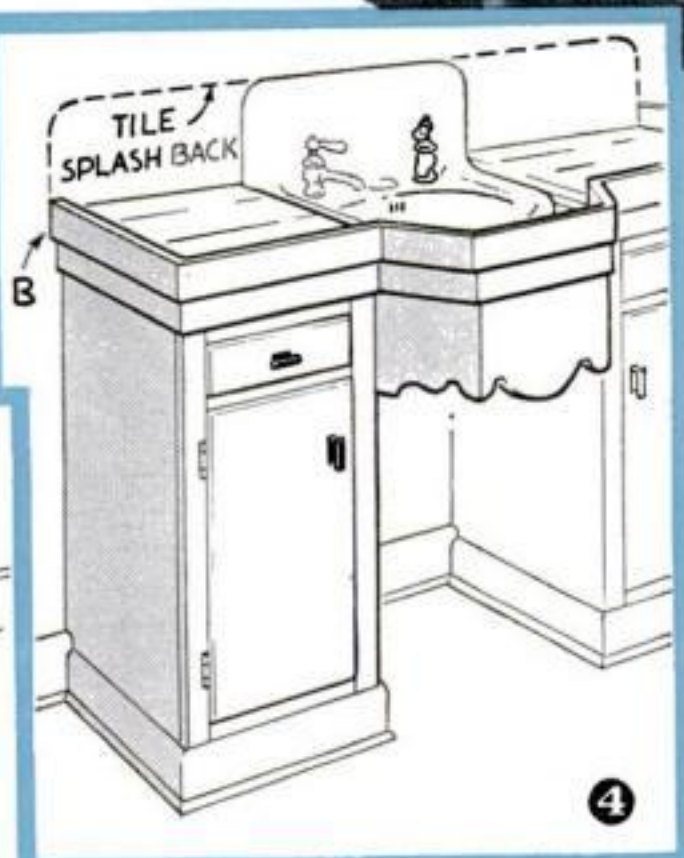
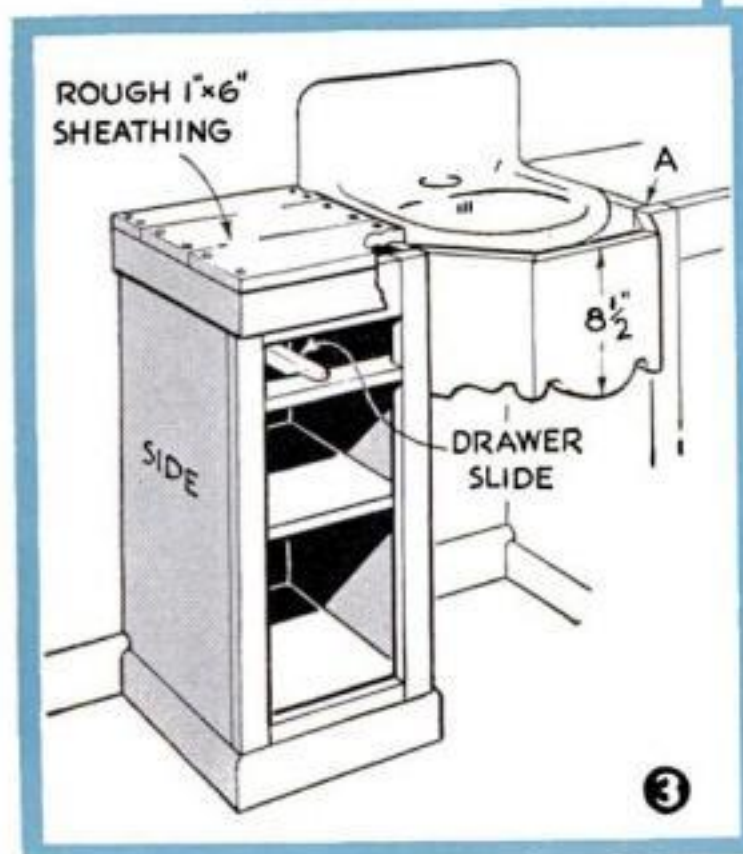
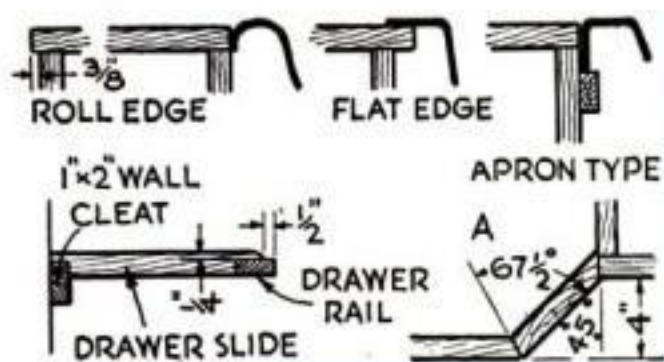
an Old Bathroom

By
LESLIE KINNING

are now made especially for building in. With these the cabinet top is extended beyond the inner sides and the bowl rests on it. Where an apron lavatory is used, butt the top as with the roll-edge type, and if it is a new installation, nail a cleat underneath to carry the edge. With an octagon front on the apron, the cabinet can be built so that the tile nosing stops at the corners, and a flat apron is fitted beneath the bowl, thus avoiding the expense of building around the front of the lavatory. It is best to have a tile-setter do the necessary tile work.

The construction of the large dressing table is similar to the Pullman. The back ends of the drawer guides are carried in notches in a vertical cleat nailed to the wall. Notice the bottom compartment, which is closed by a lip door having spring hinges at the lower edge. The top carries no wooden trim because the projecting tile nosing with a tile quarter-round is sufficient finish.

Sometimes a space is left between the bathtub end and the wall, and this can be used for a case. A perspective sketch

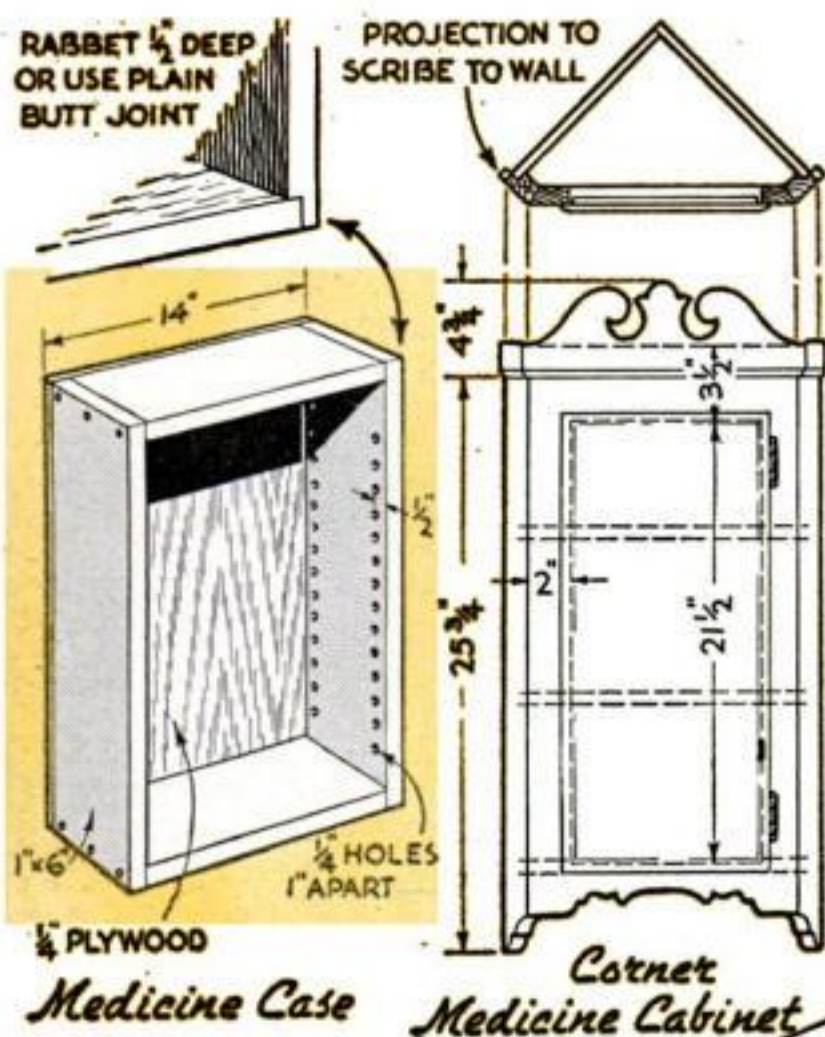


A dressing table may be built along one wall if there is sufficient room. Tile is used for the tops

shows a small door opening into the room at the bottom, with two shallow drawers opening over the tub for towels. A variation would be to substitute a deep drawer for the door, with the framing arranged

as in the framing detail. If the tub has a seat at the end, the drawer chest can be built above it.

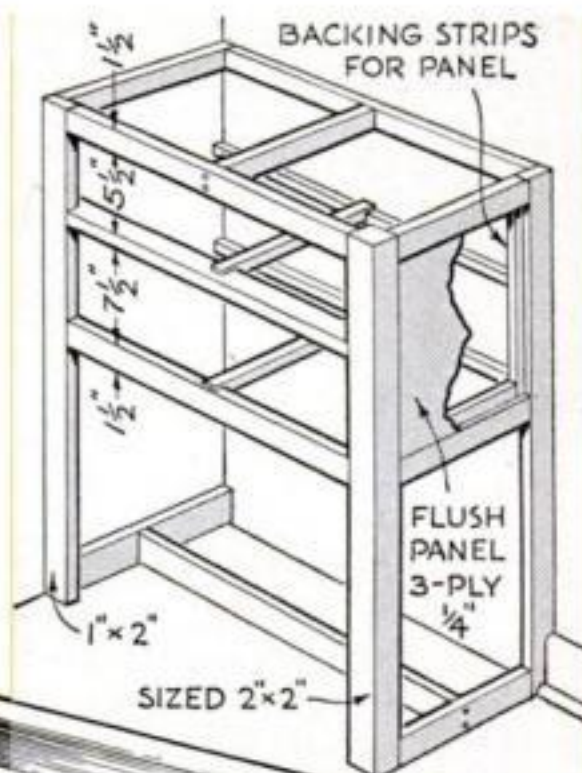
Medicine cases, fitted with mirror doors, are for sale ready-made at prices



be either wood or glass. Neater yet are metal adjustment strips, which may be bought and installed. When a case is put in the wall between studs, the joint is hidden with a molding mitered around. Hinge a modern, unframed mirror door to it.

Corner cabinets are easily installed in old bathrooms. The combination of two of these above a Pullman lavatory is excellent. If the bathroom is large enough, a wardrobe may be built across one end or in a corner.

Suggestions for obtaining more drawer and cabinet space in the bathroom. A drawer may be replaced by the door shown below



Tub-End Cabinet

so little above the cost of a mounted mirror that it hardly pays to build them at home. However, individual designs are attractive, and two suggestive sketches for construction are given. One, intended to fit between studs, is simply a box backed with plywood. Shelves may be nailed in, but it is better to bore holes for the use of adjusting hooks. The shelves may

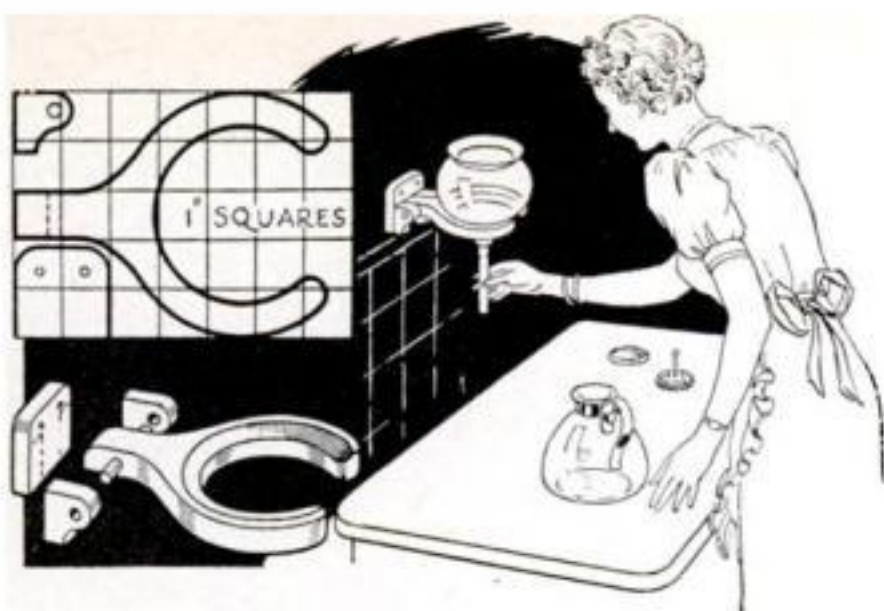
SPREADING RATES, PAINTS AND FINISHES

[PAINTING]

Kind of Paint or Other Finish	No. of Coats	(in sq. ft. per gal.) Spreading Rate
House paint, light.....	2	300-350
" " dark.....	2	350-450
Household enamels, 4-hr. type.....	1	250-300
Interior gloss paints	1	450-500
Floor and deck enamels	2	250-300
Flat wall paints, oil type.....	2	250-300
Casein wall paints, water type.....	1	500-600
Barn and ordinary roof paint.....	2	250-300
Shingle stain, brushed	1	200-300
Metal primers	1	500-600
Cement and stucco paint	1	250-350
Oil stains, for trim	1	500-600
Penetrating stain, for trim	1	400-500
Acid stains (water)	1	400-600
Cabin enamels (marine)	1	500-600
Clear spar varnish (marine)	1	500-600

NOTE: These spreading rates apply only to high-quality materials.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



Folding Wall Rack Holds Top of Coffee Maker

THE upper bowl of a glass coffee maker is easily broken when detached from the lower section and left standing inverted, but a safe place to keep it at such times can be provided by constructing a rack as shown. The rack folds back against the wall when not in use. Cut the parts from any straight-grained wood and hinge the arm on a $\frac{1}{4}$ " dowel. Finish with one coat of flat white paint and two coats of enamel in the color desired.—J. BRUMFIELD.



Shield Protects Boards During Paint Burning

WHEN burning paint from the walls of a house, it is often desirable to protect some of the boards from the flame. This can be done with the shield illustrated, which also keeps the heat from reaching the hand of the user. Cut the two pieces comprising the shield from 22-gauge sheet metal, bend the small piece as shown, and rivet them together.—G. W. N.



Tilting Mount for Motor Controlled by Pedal

A HANDY method of mounting the motor on a wood-turning lathe is illustrated in the photo above. A slight pressure on the pedal will raise the motor and allow the belt to be changed easily on the step pulleys. The motor is bolted to an extra wooden base, which in turn is fastened with hinges to the regular base. The foot pedal is attached to the extra base so that it is in easy reach of the operator yet will not project far enough to cause any danger of stumbling when moving about the shop.

Old Auto Valve Is Used in Grinding Glass

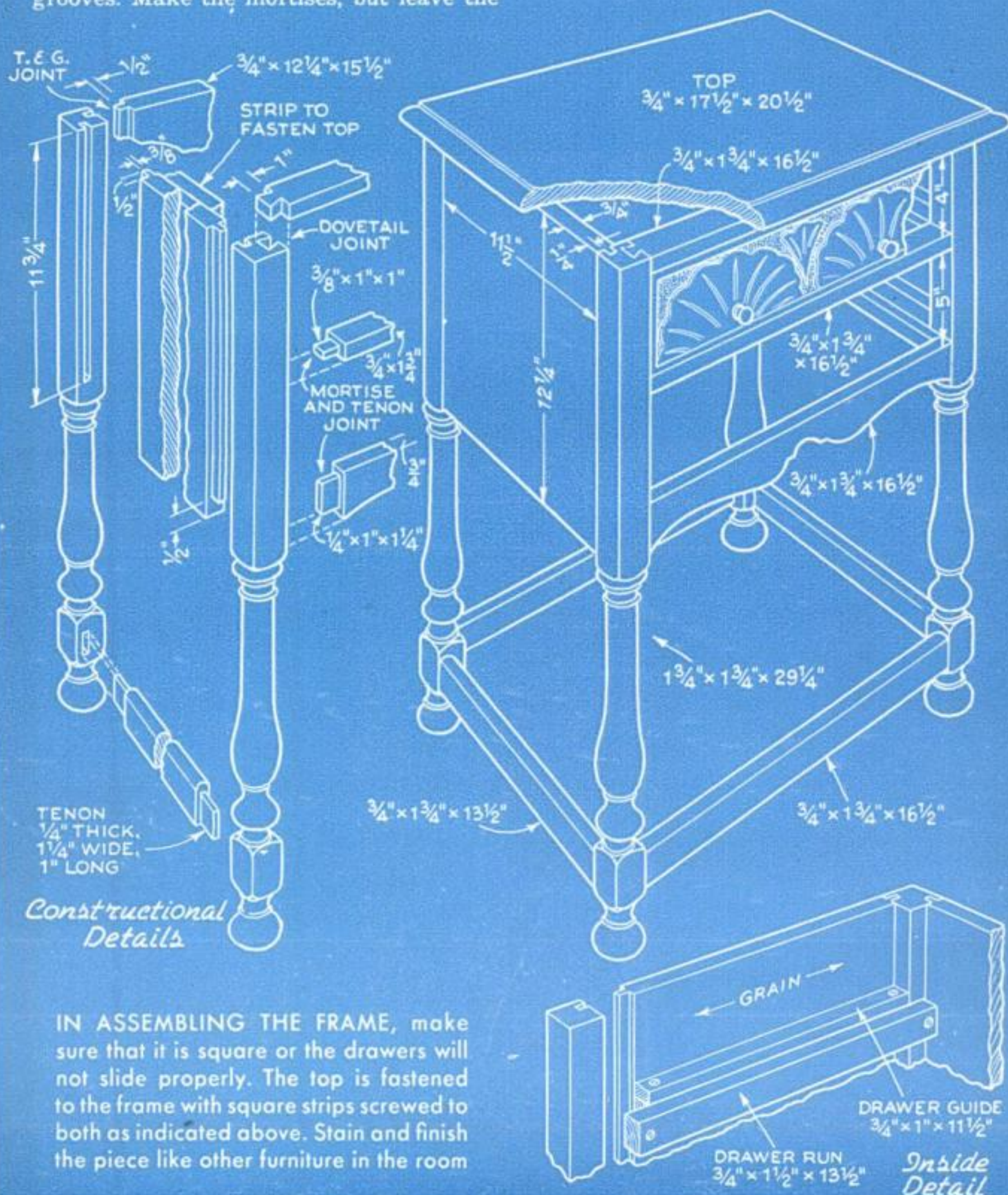
AMATEUR photographers or other craftsmen can prepare ground glass when necessary by smearing a little water-mixed valve-grinding compound on one side and using an old valve, flat side down, to grind the glass with a circular motion.—J. C.



Bedside Table Carved in

MADE of oak, walnut, poplar, or maple, this small bedside table in Jacobean style is suitable for use with Colonial furniture. Square the legs to the sizes given, turn them, and cut to length. Set up the dado head in the circular saw and cut all grooves. Make the mortises, but leave the

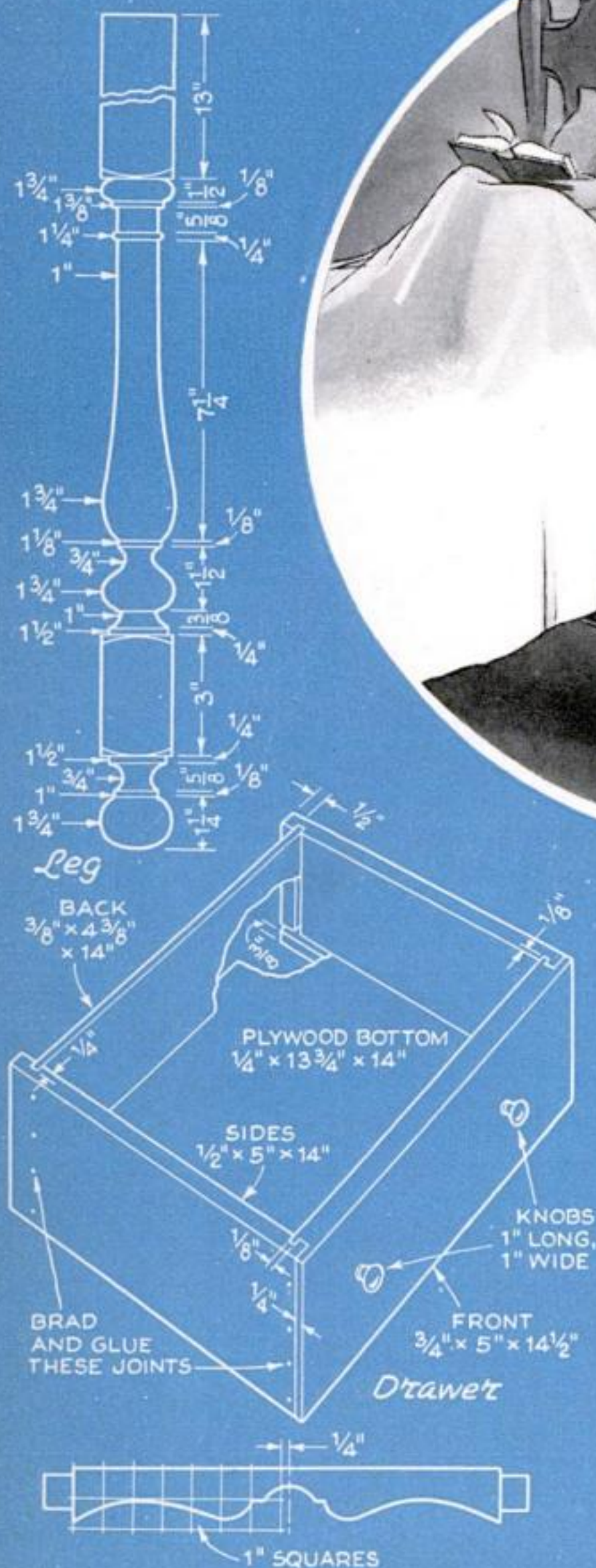
upper front dovetail mortises to be cut after the frame has been assembled. Note the method of making and assembling the drawer runs and guides. Good machine-made drawer joints may be made as shown. The edge of the top is molded on all four sides.



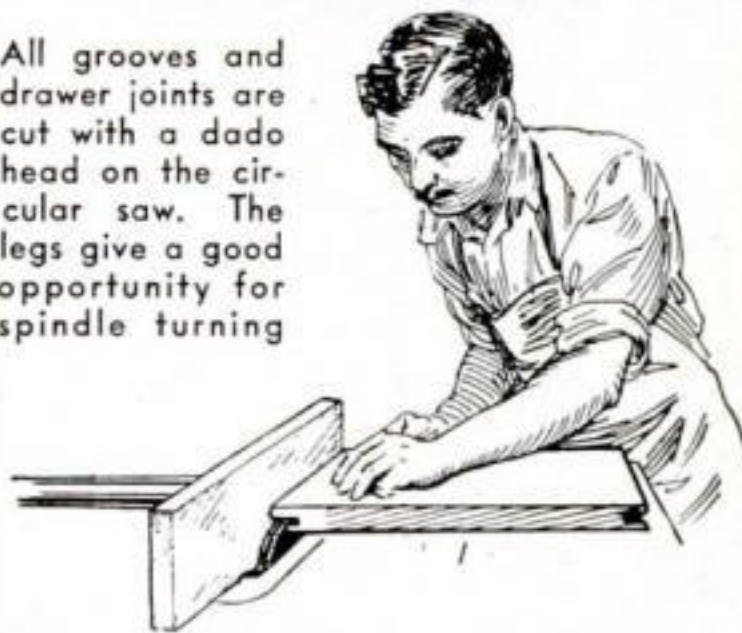
IN ASSEMBLING THE FRAME, make sure that it is square or the drawers will not slide properly. The top is fastened to the frame with square strips screwed to both as indicated above. Stain and finish the piece like other furniture in the room

Jacobean Style

Designed by
Franklin H. Gottshall



All grooves and drawer joints are cut with a dado head on the circular saw. The legs give a good opportunity for spindle turning.



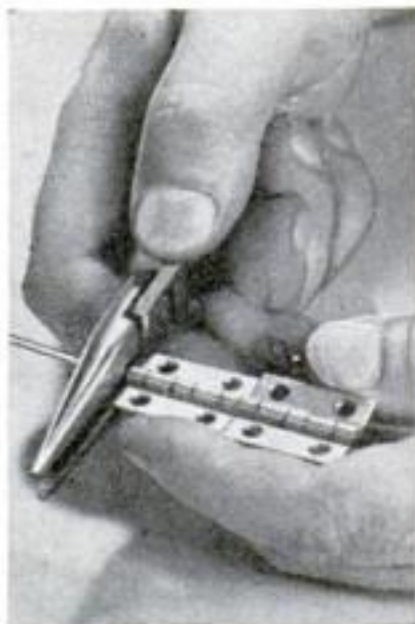


Magnifier Aids in Filing Fine-Toothed Saws

FILING fine-toothed saws is hard on the eyes, but becomes easier if a magnifying glass is attached to the end of a stick and used as shown above. A small screw will hold it in place and allow it to be moved from side to side for adjusting. The stick should be slotted so that it can be moved up or down, and a wing nut will then hold it in the desired position.—W. A. MARSHALL.

Piano-Hinge Substitute Easily Obtained

IN THE construction of some projects, additional strength is secured by the use of continuous or piano hinges. These are difficult to obtain in many localities, but may easily be assembled from the required number of ordinary butt hinges. All that is necessary is to remove the short pins from the latter and substitute one long piece of brass or iron wire as shown at right. If thought desirable for better appearance, the edges of the hinges could be carefully soldered together, but this is unnecessary so far as strength is concerned.—G. S. G.



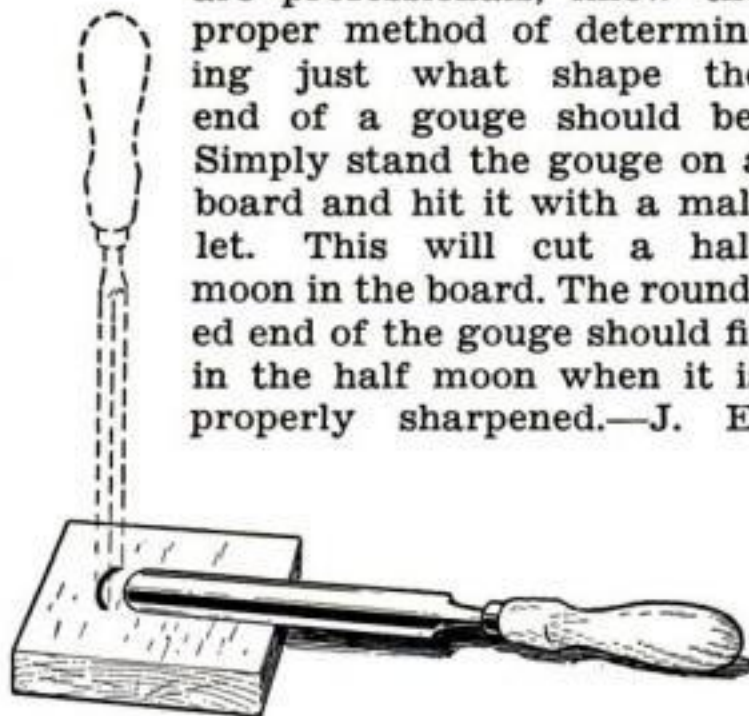
Copper Candle Snuffer of Simple Design

AN ATTRACTIVE candle snuffer can be made of scrap copper. The cone blank is a piece of sheet copper 2" in diameter, but a segment must be cut out, and this should be about 1¼" long, measured on the circumference. The thickness of the copper is optional. The handle is bent from ⅛" copper wire, which is flattened out for 1" at one end and soldered to the snuffer over the seam.



How Much to Round Off a Turning Gouge

ALL turning gouges are of necessity rounded on the cutting end, but very few wood turners, unless they are professionals, know the proper method of determining just what shape the end of a gouge should be. Simply stand the gouge on a board and hit it with a mallet. This will cut a half moon in the board. The rounded end of the gouge should fit in the half moon when it is properly sharpened.—J. E.

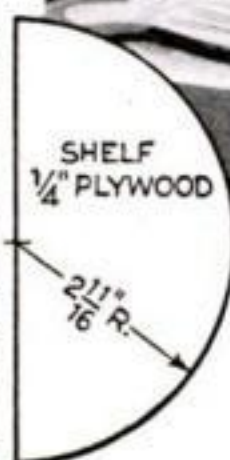
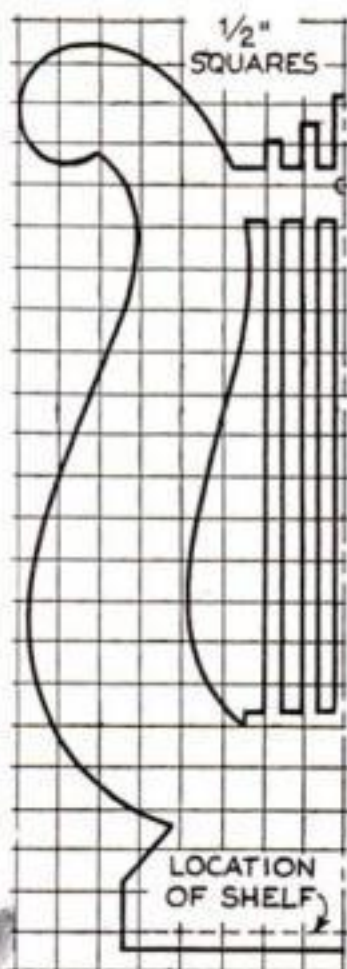
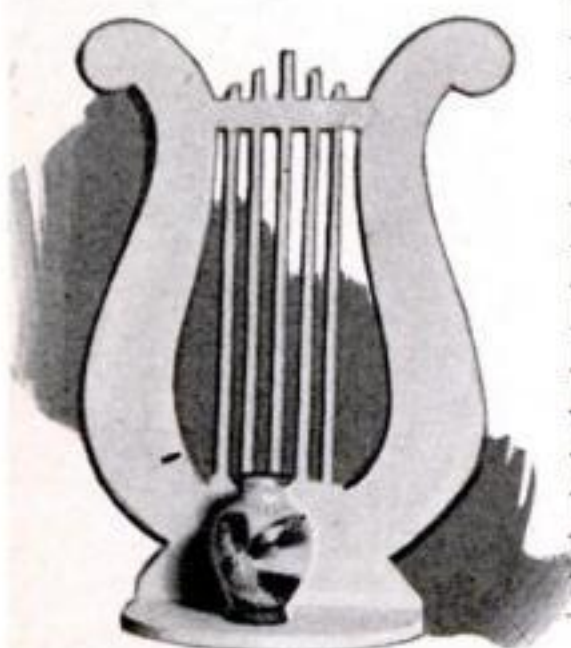


Small Bits of Solder Saved for Delicate Jobs

THE next time you "tin" your soldering iron, save the little shotlike particles of solder that roll around on the workbench. Gather them up with a pair of tweezers and place them in a small bottle. They will come in handy the next time you need a few bits of solder for some especially delicate job.—WARREN L. CASTERLIN.

Lyre-Shaped Whatnots Quickly Made on Jig Saw

SMALL whatnot shelves are quickly made for gift purposes or for sale. Fasten four layers of $\frac{1}{4}$ " plywood together with brads, mark lyre design on the top, drill $\frac{1}{8}$ " holes between "strings," and jig-saw all inside cuts. Then saw outside shape and sand edges. Cut shelves in same way, and glue and brad them to backs. Finish with several coats of flat white paint or one coat of undercoater and two coats of enamel.



Brads and glue are used to fasten the shelf to the back. The lyre is 11" high and the shelf has a radius of $2 \frac{11}{16}$ ". The completed project is shown at the far left



Strips of Old Inner Tube Grip Odd-Shaped Work

SOMETIMES suitable clamps are not available for holding irregularly shaped work that has to be glued. When such is the case, a long rubber strip cut from an old auto inner tube can be used for wrapping around the work. The strips should be quite narrow, as shown above. If well stretched as it is applied, the binding will contract to hold the work securely.—H. H.

Benzine Cleans Tracing Cloth

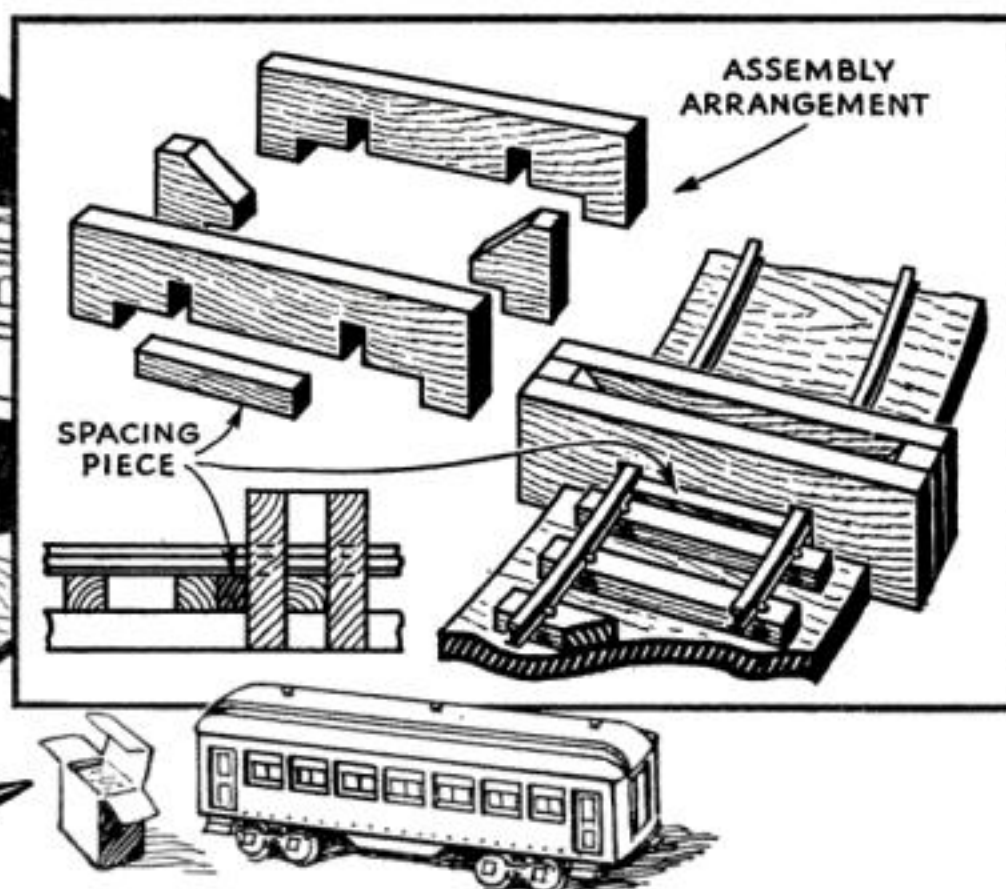
TO CLEAN tracing cloth, use a soft flannel cloth and benzine. Stroke in one direction only. Do not smoke while doing this work. If reinking is necessary, give such areas a rubbing with a soft cloth dusted with talcum just before inking.—R. G. W.

Ink Fountain Inserted in Rolling-Up Plate



CRAFTSMEN who do linoleum block printing or celluloid etching can conserve ink and save time with a fountain made from an old grease cup, as large as possible. Drill and tap a hole in the rolling-up plate to take the cup threads, and screw the cup to the underside so that the small opening barely projects above the plate. Fill it with the printing ink most frequently used, screw the cap on, and attach to the plate. When ink is needed, turn the cap slightly.—J. C.

Track Gauge Spaces Model Ties and Rails



ACCURACY and speed in laying scale-model railroads may be attained with this simple gauge. Constructed from plywood, it fits over the railroad bed so as to hold the ties in place and space the rails evenly.

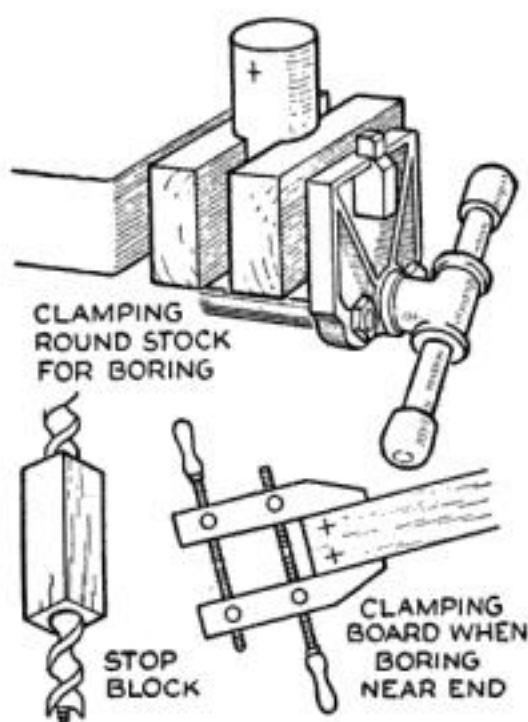
The dimensions for the gauge are obtained by taking measurements of the base, tie, and rail. It may be used on both straight-aways and curves.

To lay ties, the gauge is lifted slightly so

that a tie can be slipped beneath it. The end pieces of the gauge center the tie on the baseboard. The gauge with the tie in position is then slid back until the small spacing piece on the gauge presses against the last tie laid so as to insure correct spacing between the ties. The scale spikes which hold the rails and ties to the base are then forced in with thin-nosed pliers or driven into place with a light hammer and a slim nail set.—TED B. KELLER.

BORING WITH AUGER BITS

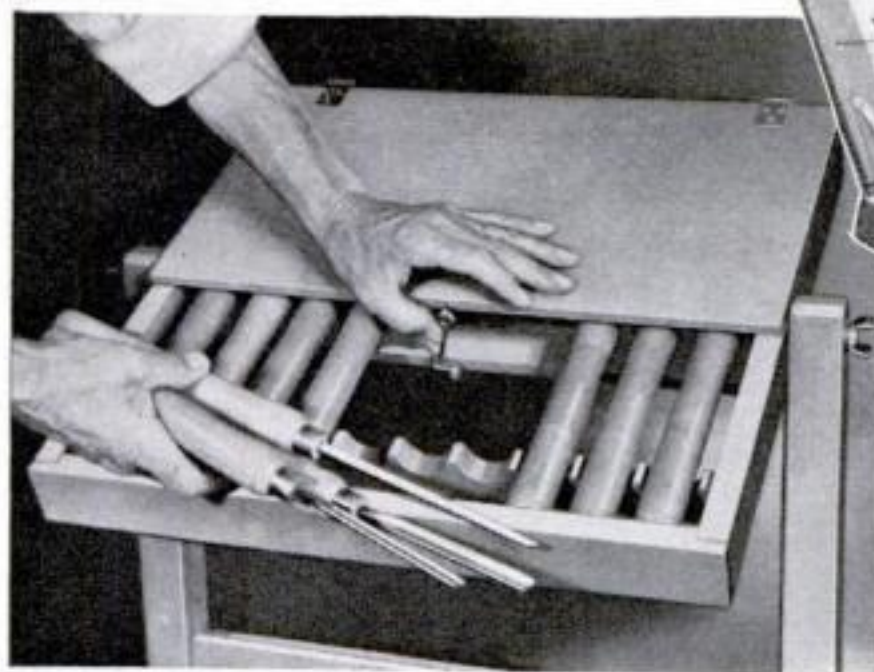
[WOODWORKING]



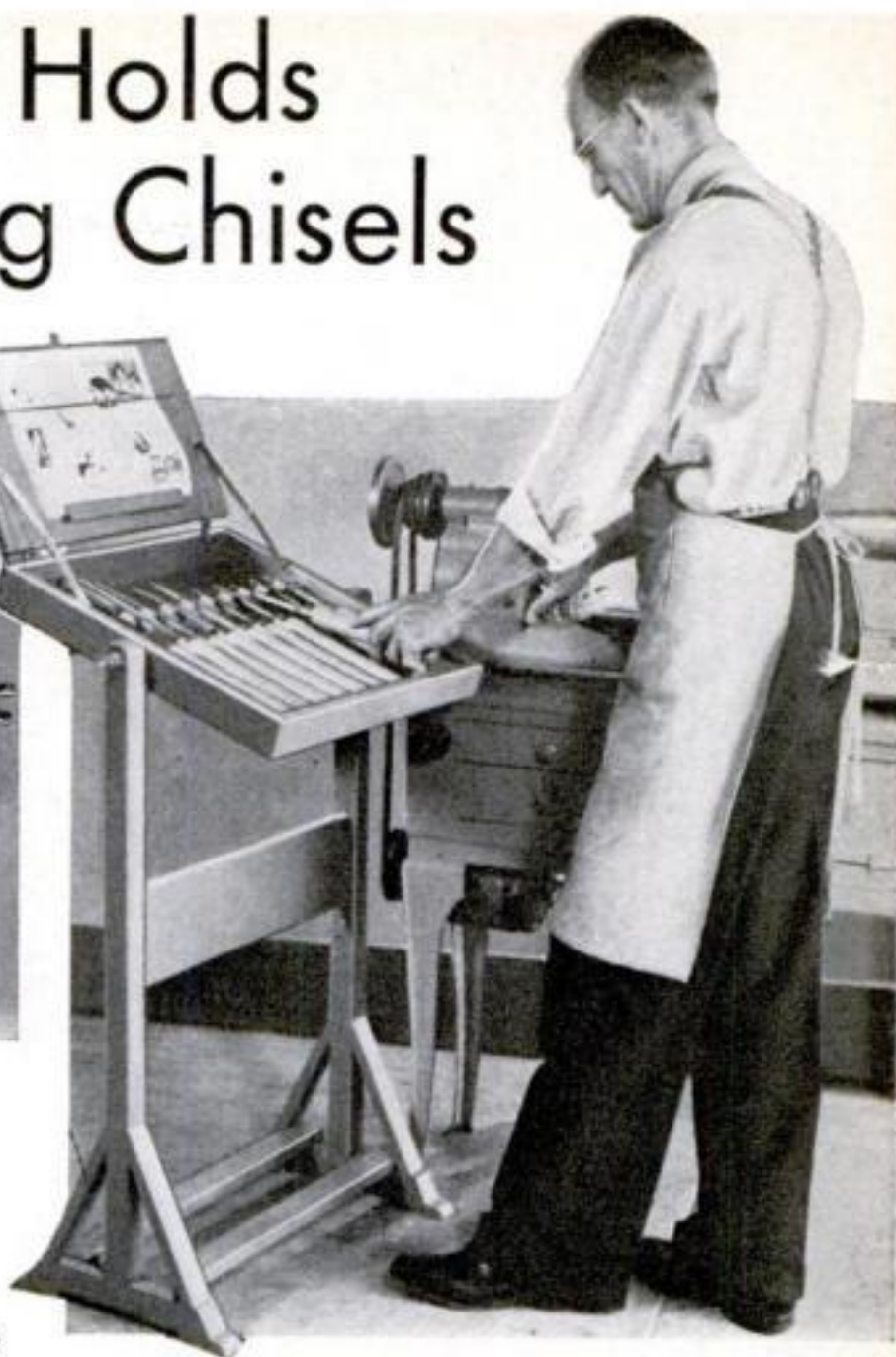
1. To aid in boring straight, both vertically and horizontally, test frequently with a try-square.
2. Clamp a board to prevent splitting when boring near the end.
3. Bore through holes from one side until the screw is visible on the opposite side. Remove the bit and complete the hole from the other side. Holes may also be bored right through from one side if a piece of wood is first clamped to the opposite side so the bit won't tear the wood when it breaks through.
4. Hold round stock firmly in the vise by clamping between two hollow blocks or V-blocks.
5. Bore holes to uniform depth by using a wooden block or other gauge as a stop on the bit.
6. Bore through leather and thin materials by clamping them between two boards.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Tilting Cabinet Holds Woodworking Chisels



The lid is fastened to the back with a screen hook and acts as a magazine support when open



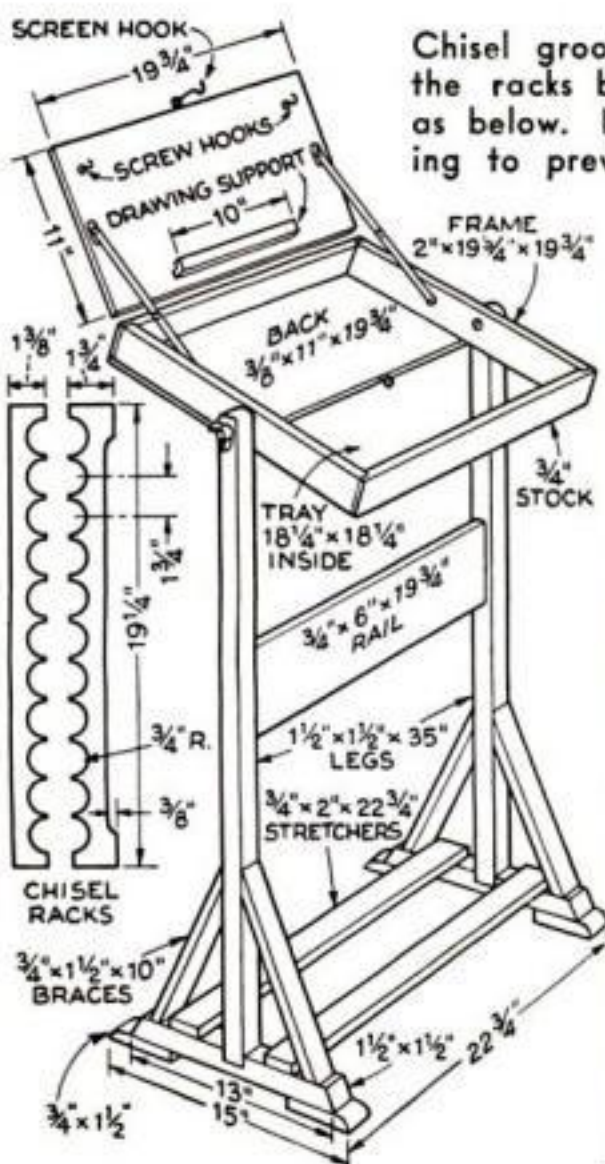
IF KEPT in the tilting cabinet illustrated, wood-turning chisels are always ready for instant use, and the right one can be chosen at a glance. The cover also serves as a support for a magazine or blueprint containing the drawings of the turning that is being made. When not in

use, the rack is turned to a vertical position so that it will take up less room.

The measurements given are for a cabinet to hold ten chisels not over 18" long and with uniform handles $1\frac{1}{4}$ " in diameter. Pine can be used for the framework, but hardwood is preferable for the chisel racks. These pieces are nailed inside the frame

flush with the bottom edge. One is set 2" and the other 11" from the front of the frame. Note that the upper rack is $1\frac{3}{4}$ " wide and is cut out along the bottom so that shavings may easily be removed. The lower half of the tray is left open for the same reason. Both the bottom and the lid are the same size. The lid is hinged with 1" oblong back-flap hinges and supported with 10" jointed desk slides.

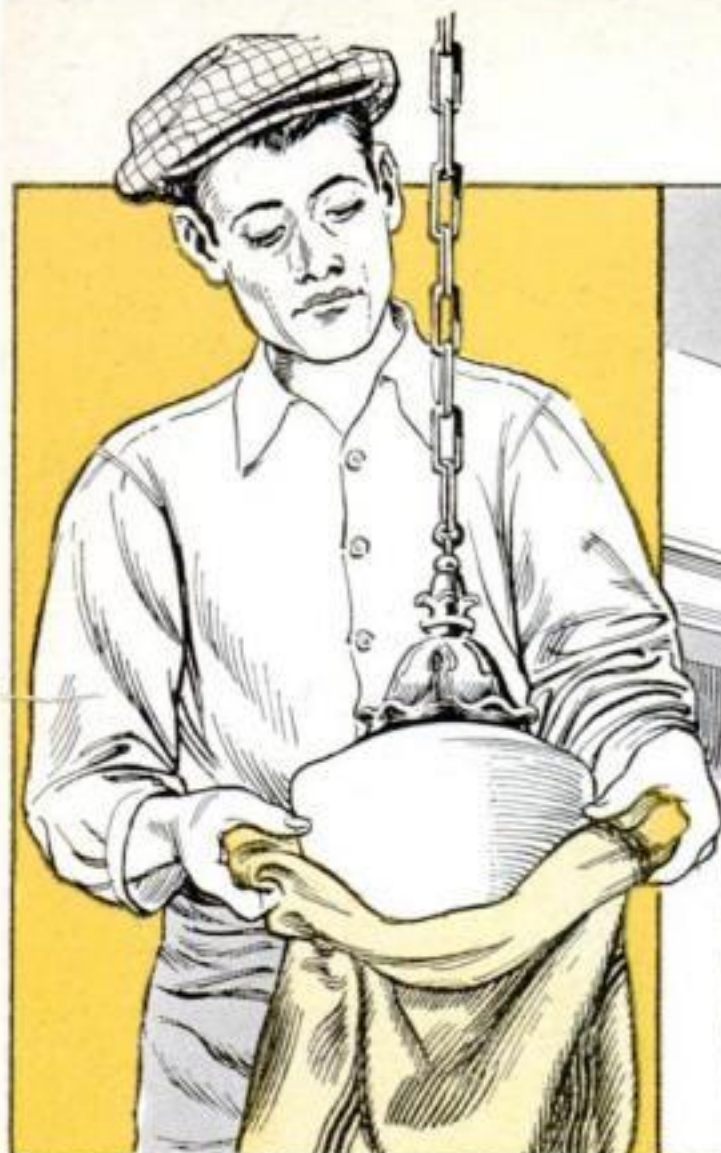
In constructing the stand, fasten the center rail to the legs either with $\frac{3}{8}$ " dowels or four 1" corner irons. A $\frac{3}{8}$ " hole is bored in each upright near the top and midway in the sides of the tray so the tray can be mounted in place on two $2\frac{1}{2}$ " by $\frac{3}{8}$ " carriage bolts with wing nuts.—FRANK HEGEMEYER.



Chisel grooves are cut in the racks by boring holes as below. Note the backing to prevent torn holes



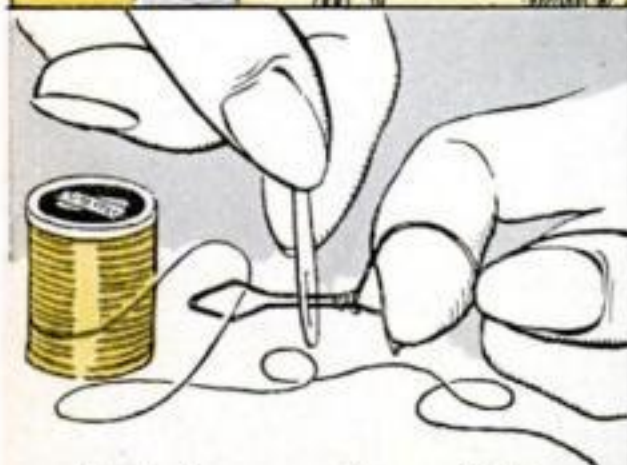
KEEPING THE



When a room is being refinished, the lighting fixtures may be guarded against paint splatters by slipping old grain or sugar sacks, or even paper sacks, over them



Delicate glasses and fragile, expensive pieces of china can be washed with less danger of chipping if a clean hand towel is first placed in the bottom of the dish pan as a sort of pad



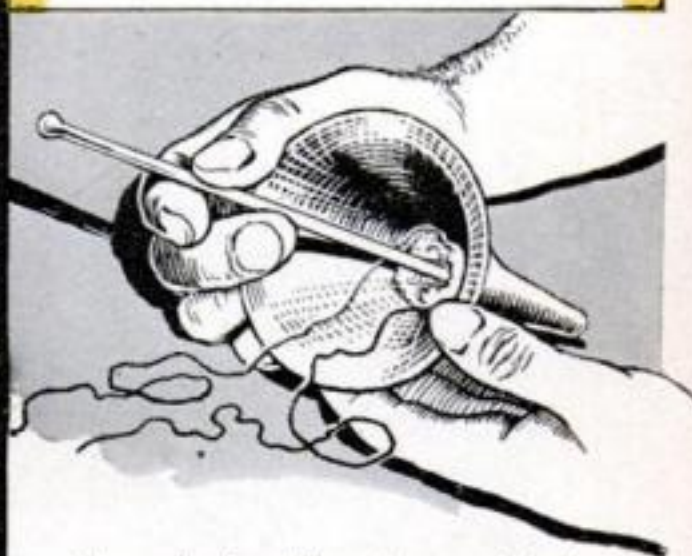
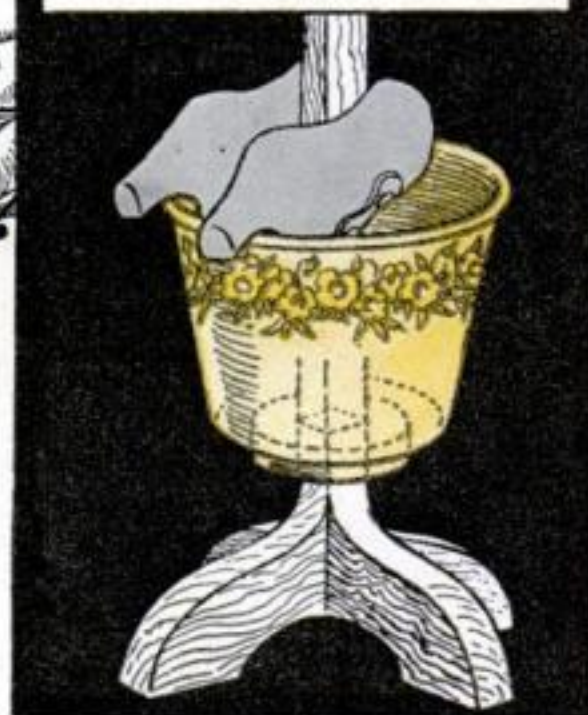
Made from a piece of thin wire, such as florist's binding wire, this "eye opener" aids in threading either a sewing-machine needle or an ordinary needle when there is insufficient illumination



In stormy weather, overshoes and rubbers are usually underfoot in the hall. A receptacle for them can be made from a metal wastebasket. Cut a hole in the bottom to fit over the hatrack and mount on a wooden block



Amateurs can fit linoleum better around projections or odd-shaped objects if a template is first bent to shape from stiff wire (such as a clothes hanger). Then trace around this on the linoleum



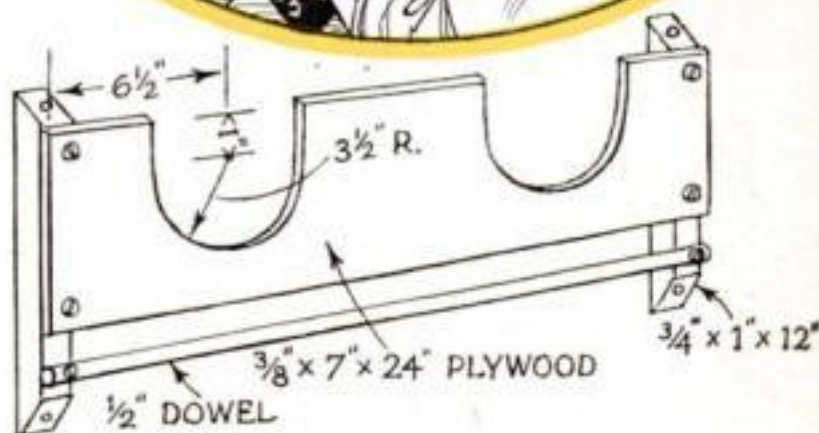
A wad of cotton tamped into the neck of a funnel as a filtering medium can be removed without soiling the hands if the middle of a piece of string is first placed in the funnel neck. The string pulls out the cotton

HOME SHIPSHAPE

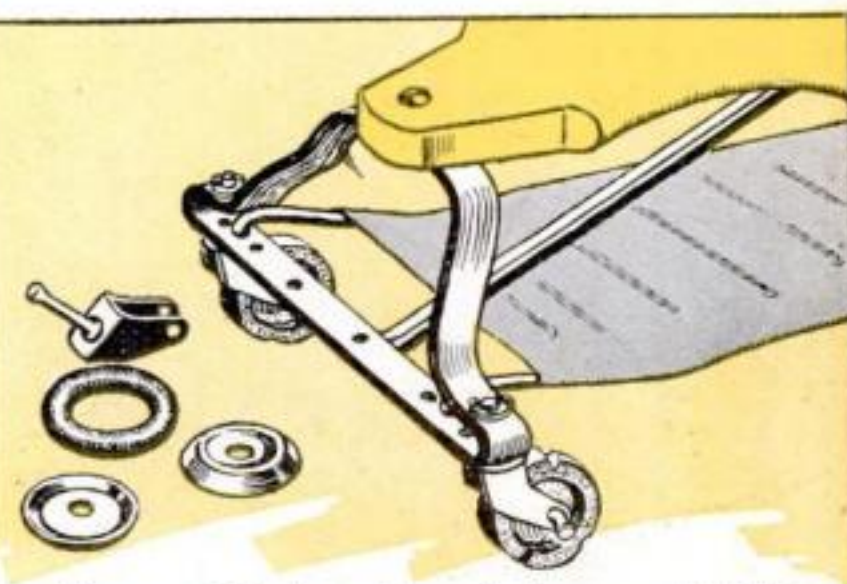
A baby is less likely to slip and fall on well-polished floors or waxed linoleum if strips of adhesive tape are stuck on the soles of his shoes. Use a heavy tape of the surgical type



A spoon used for stirring may be prevented from slipping into a pan by means of the common detachable type of pencil clip. It is bent to fit the spoon handle and clips on the rim of the pan



Installed on the inside face of a bedroom closet door, this rack provides a convenient place to hang up a man's hats, neckties, belts, and whisk broom or clothes brush. It is made of wood, assembled with screws, and stained and finished as desired. Dimensions can be changed to suit the door



Worn-out front caster wheels on a baby's stroller can be replaced with solid rubber wheels taken from a set of new bureau casters and costing only ten cents each. At the left is a scraper made from a small trowel for removing wall paper over stairs. Wet the paper first with a long-handled brush

Better Ways to Do Sanding



Using a step sanding drum for smoothing the edges of an ornamental wood bracket

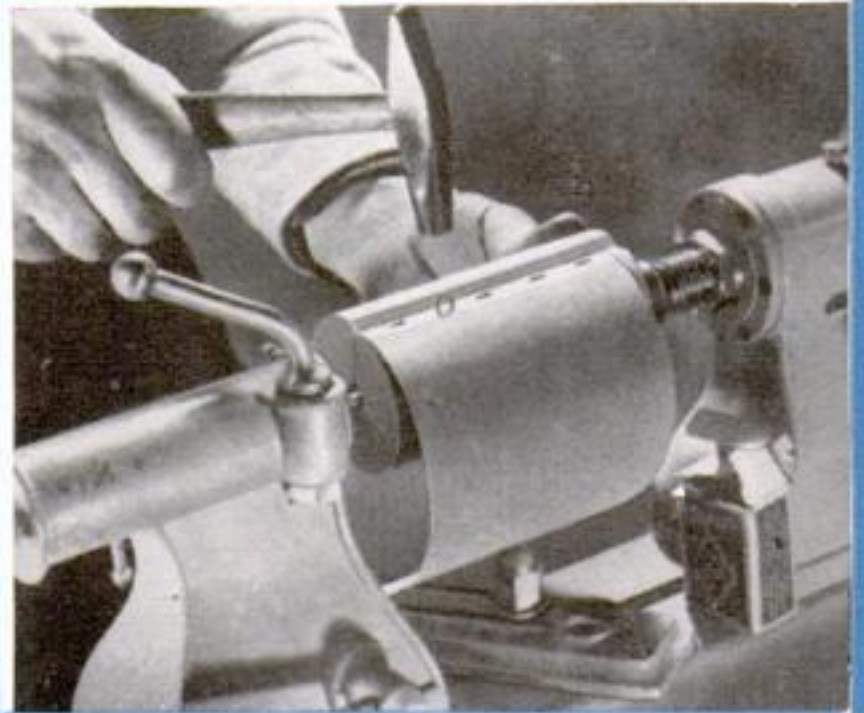
By

HOWARD R. HEYDORF

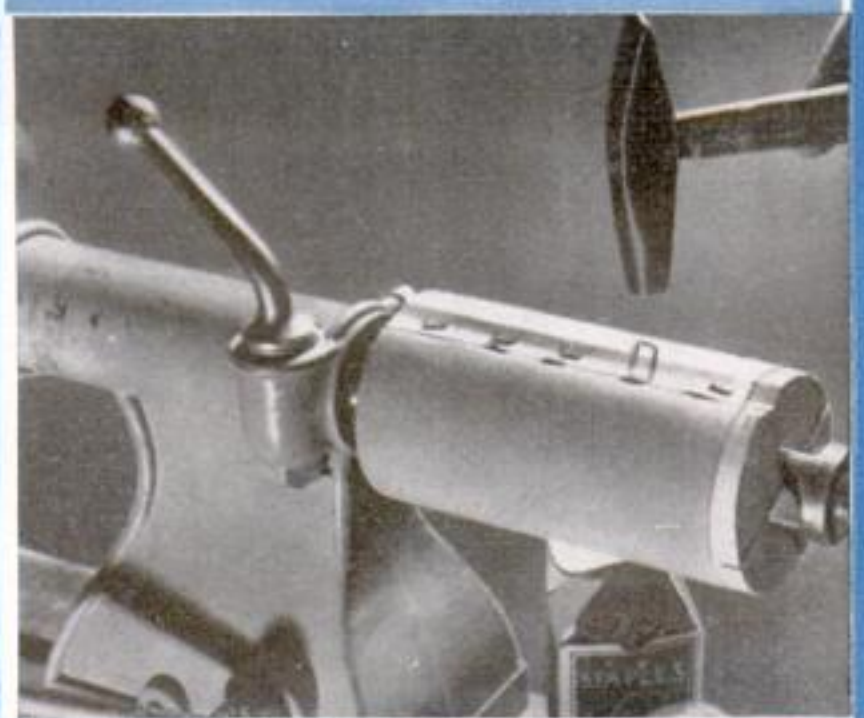
SANDING drums and sanding disks for use in the lathe are often necessary in finishing odd-shaped and curved pieces of wood that would be difficult to smooth by any other method. In many cases these drums and disks are constructed as they are needed, but without much thought as to the best methods of making or using them. The accompanying illustrations show several ways to do quicker and more accurate sanding with these accessories.

For smooth and accurate work, the drums should be of slightly smaller radius than the curve to be sanded. Instead of changing the drums to fit the curve in the work, the drum may be shaped in steps as shown. The wood to be smoothed then may be moved from one step to another as the radius of the curve changes.

An easy and satisfactory method of fitting sandpaper to drums is to cut a V-groove about $\frac{1}{4}$ " wide and $\frac{1}{8}$ " deep, running the length of the block. One end of the paper is tacked into the groove, and the paper is wrapped around the drum in the direction opposite to which the drum ro-



After a V-groove has been cut the length of the drum, one end of the paper is tacked into it (above), then the other end (below)

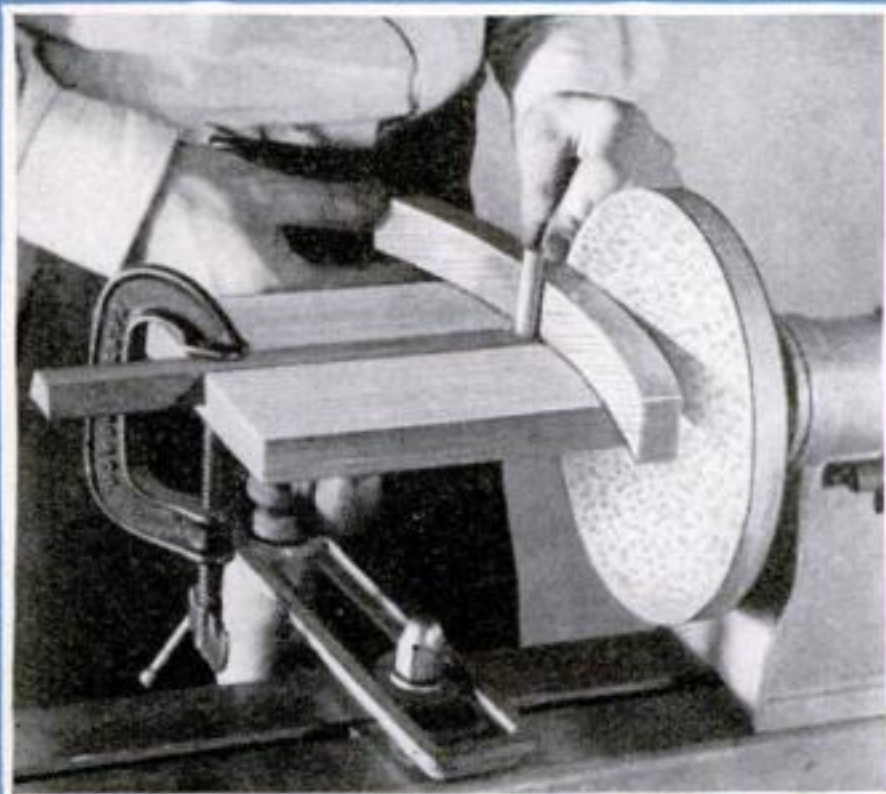


tates. The paper is pulled tight, and the other end is tacked. Small double-pointed tacks are excellent for this purpose.

Serving a purpose similar to that of a stepped drum, the tapered drum illustrated is very useful for thin work where it is essential to have the correct diameter. The work must be tipped slightly so as to be at right angles to the edge or surface of the drum, and it is moved along to a point where the curve fits.

A tilting table for use with sanding disks may be constructed from pipe fittings of the $\frac{3}{4}$ " size. These are screwed tightly together with the exception of the short nipple between the two elbows, which should be just tight enough so that a slight amount of

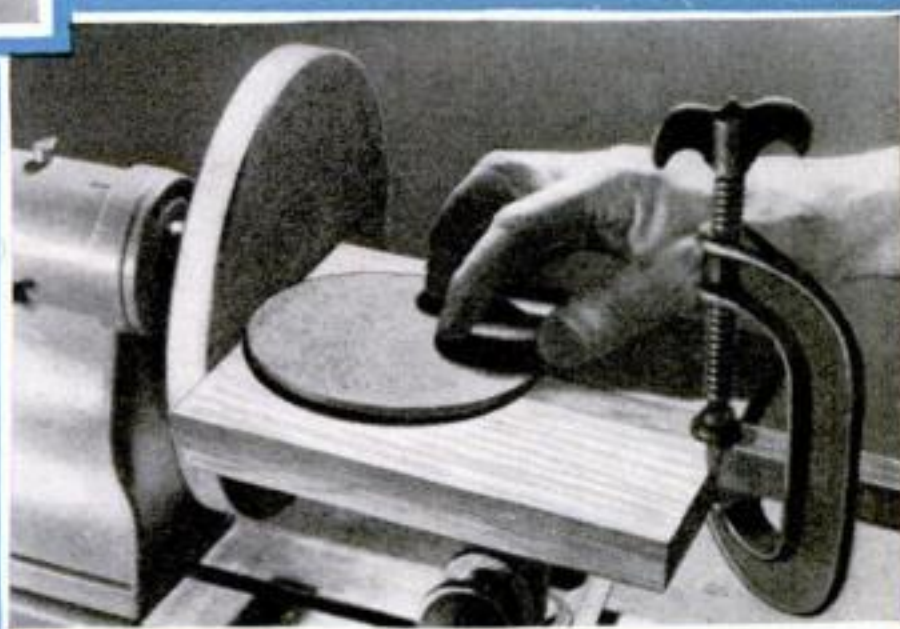
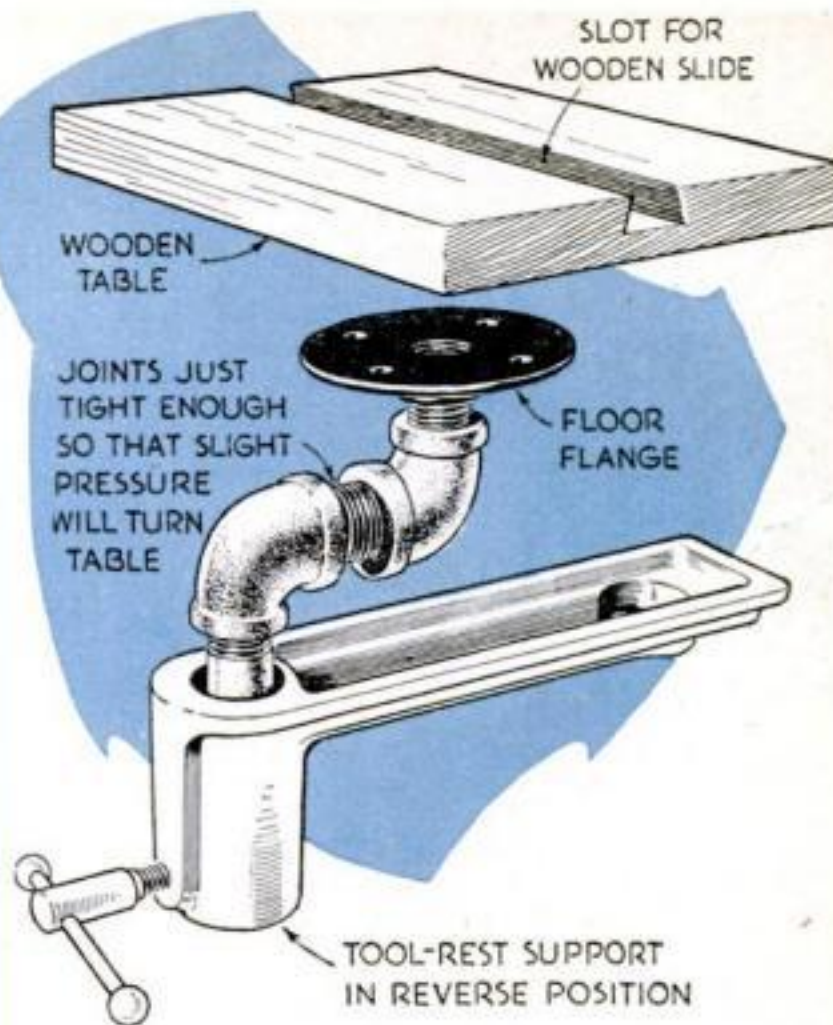
in Your Lathe



A peg in a sliding strip of wood serves as a guide in sanding a curved piece to a uniform width. At right, using a pivot to sand a disk

pressure will turn it. This enables the table to be tilted as required. Note that it is necessary to reverse the position of the tool-rest support to provide clearance for this arrangement. A wooden table is fastened to the floor flange, and the assembly is used in the regular manner for sanding.

The utility of the table is considerably increased if it is grooved and fitted with a wooden slide about 1" wide and $\frac{1}{2}$ " thick. The end of this is fitted with a metal point to serve as a pivot when sanding disks. The wooden slide is locked in the cor-



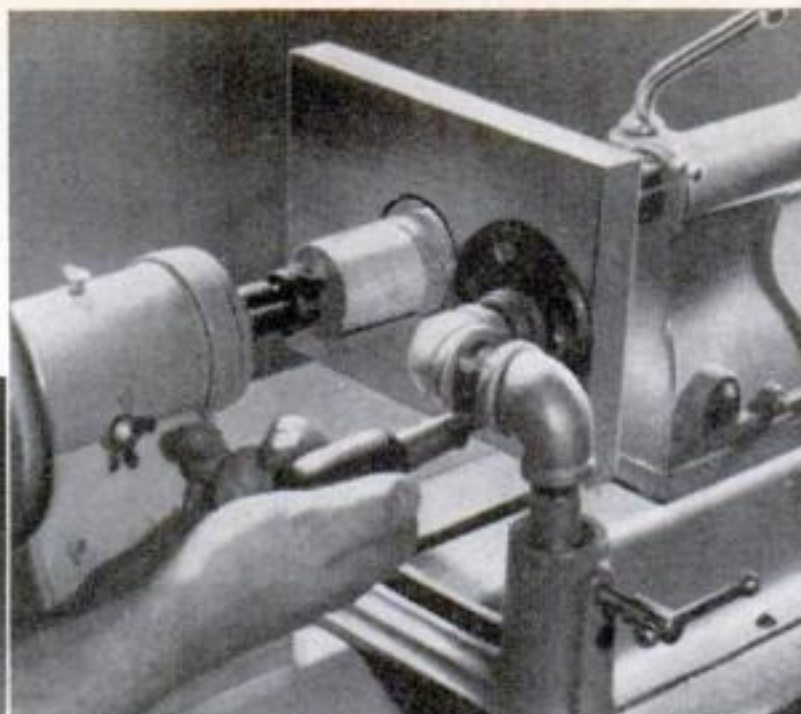
rect position by means of a C-clamp. The center of the material is placed on the point, and the work is revolved to make it perfectly round. The table can be improved by dovetailing the groove for the slide.

Another slide may be made with a wooden dowel inserted near one end. This is useful for sanding curved wooden strips to a uniform width. The inside curve is first sanded on a drum; then the strip is passed between the wooden dowel and the sanding disk to finish the outside curve.

For perfect sanding on the

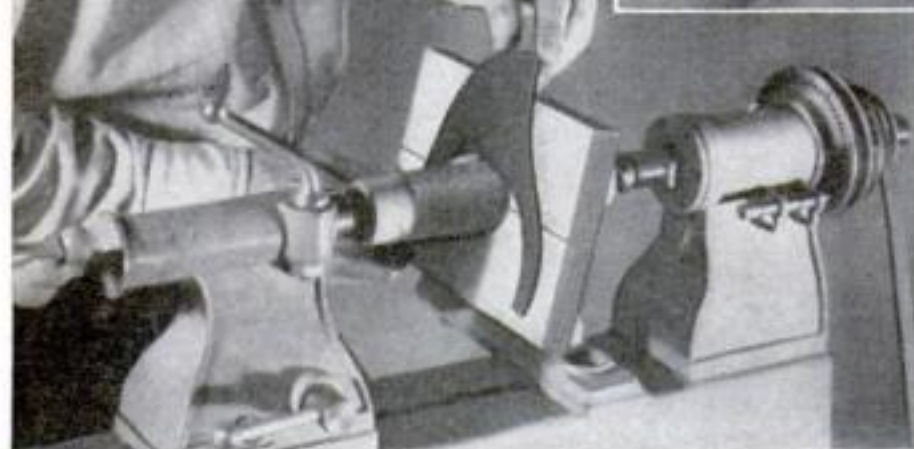


A tapered drum is useful for thin material. Note how work is held at an angle



Fastening the upright table to the flange. Make the hole for the drum large to provide clearance when the table is tilted

Below, a sanding disk will have a faster-cutting surface and will last longer if it is occasionally cleaned with a stiff wire brush. The power must be shut off



Sanding a bevel by tilting the upright table. Only the top of the drum is used when sanding at an angle



drum, it should be fitted with an upright table or guide fence. The one shown makes use of the same fittings as the tilting table for the sanding disk. It is equipped with a wooden table through which a hole is bored for the sanding drum. This table may also be tilted to give any desired bevel to the work. When it is tilted, care must be taken

not only that the work is held firmly against the table, but also that it touches only the top side of the drum.

A simple kink that will prolong the life of the sanding disks is to brush them at intervals with a stiff wire brush as illustrated above, but never do this while the power is on.

PROTECTIVE COATING FOR PAINTED WALLS

[PAINTING]

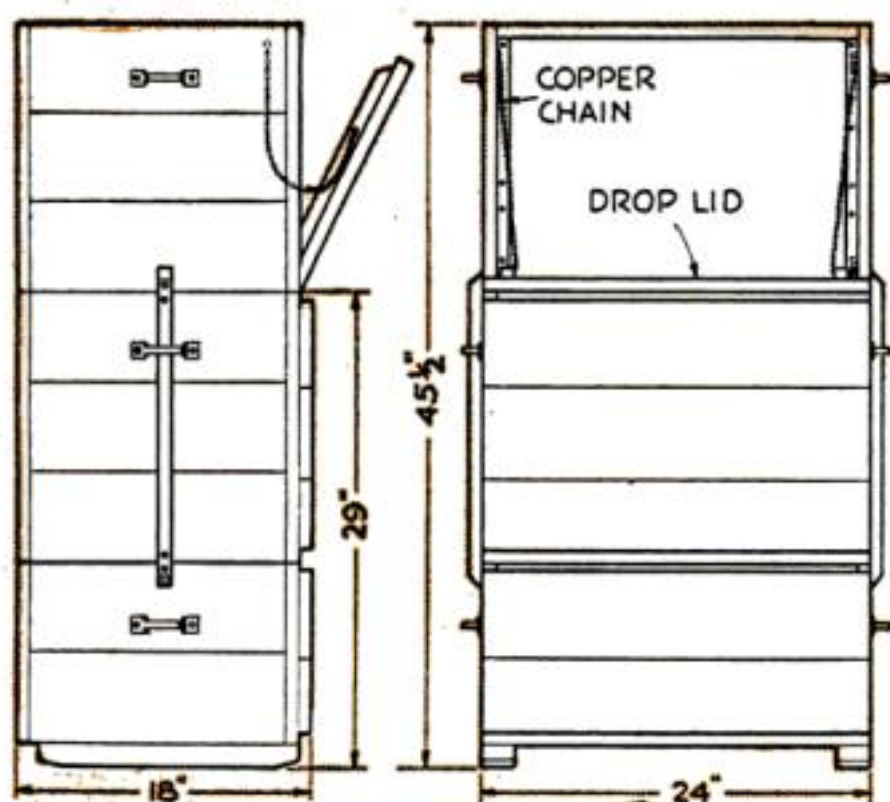
Painted wall finishes of the more expensive types, such as stippled, glazed, or Tiffany finishes, may be protected by applying an invisible starch coat over them after they have dried perfectly hard. A cupful of laundry starch is blended with a pint of cold water until the liquid resembles milk. Boiling water is then added while the starch is carefully stirred until a clear, pale-blue solution results. This is allowed to cool before being applied. Use a wide calcimine brush and stipple the coating carefully to avoid any excess, which might cause shiny areas. If the starch should crawl or creep during brushing, add two table-spoons of vinegar to each gallon of starch solution.

When the wall becomes soiled looking, the starch can be removed with warm, slightly soapy water and a sponge. The paint beneath will be as clean and fresh as if new. After the walls have dried, another coat of the protective starch solution should be applied.

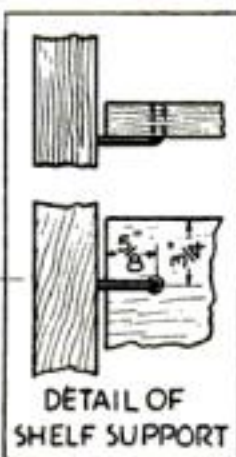
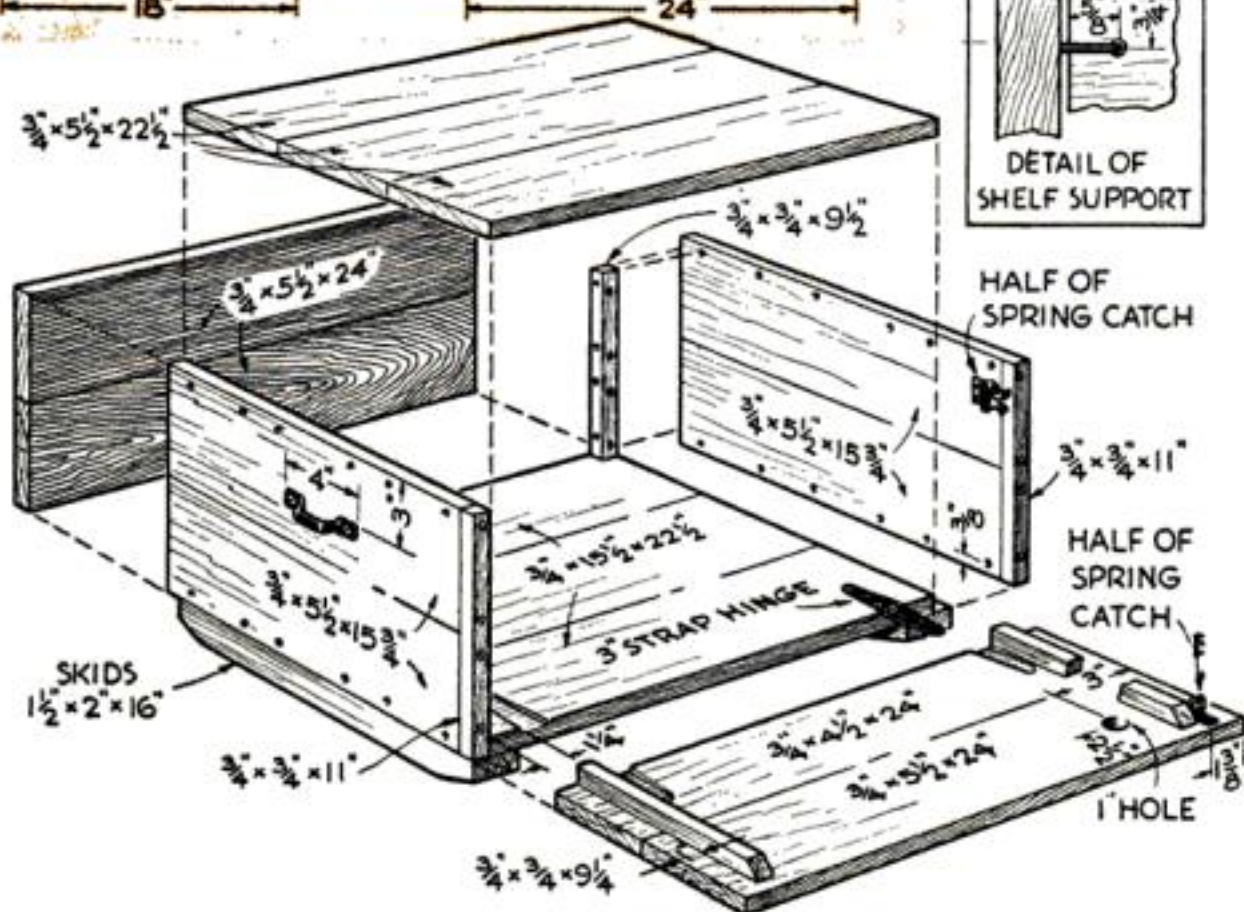
POPULAR SCIENCE MONTHLY SHOP DATA FILE

PORTABLE PINE DESK FOR A BOY'S ROOM

By Lewis McMurdie



The desk is actually three packing cases with handles so that they can be carried separately. Left, how the inner unit hangs on hooks



DETAIL OF SHELF SUPPORT

HALF OF SPRING CATCH

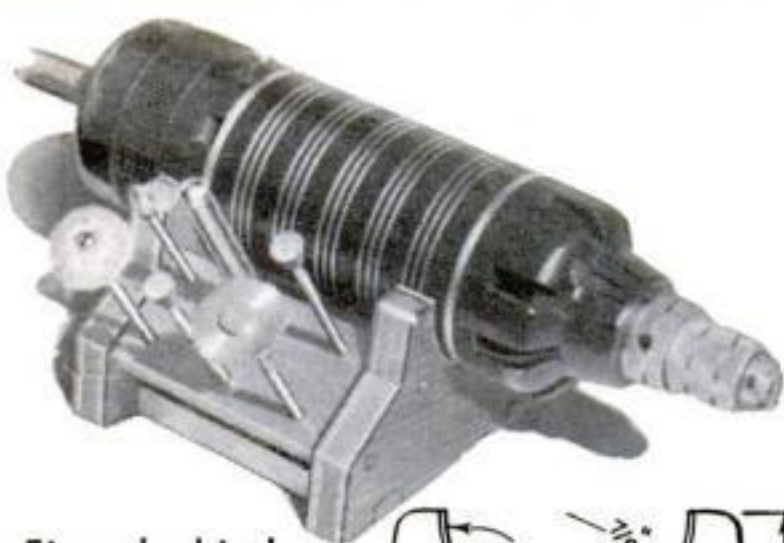
HALF OF SPRING CATCH

The perspective drawing shows the details of the bottom box. The other two boxes are the same except that a 5 1/2" board is added to the height, the cleats are 5 1/2" longer, and there are no skids on the bottom. Two chains are used to support the front of the upper box when used as a desk. One chain is used in the middle box and none in the lower box. It is best to cut all boards to size first and drill and counter-sink holes for the wood screws because uniform spacing adds much to the

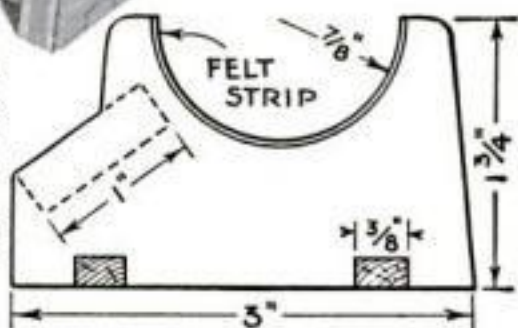
FOR a boy's room, this desk has the advantage of being inexpensive and easy to move about. In fact, it is nothing more than three packing cases with handles so they can be carried separately, contents and all. The material is 1" by 6" knotty white pine, surfaced four sides, which is uniformly 5 1/2" wide. The only planing necessary is on the 3/4" square cleats and one edge of the three front pieces that have to be ripped to 4 1/2" wide.

The hinges should be counter-sunk until the hinge line is in the corner of the boards. The original desk was finished with walnut stain and three coats of spar varnish.

The shelving and drawer in the upper part were made of 3/8" plywood assembled with 3/4" No. 6 wood screws. This whole inner unit, which may be designed to suit the individual, is hung on hooks as shown in a detail drawing, and can easily be removed.



Five-ply birch is used to make the rack because of its attractiveness when varnished



Bench Rack Holds Small Hand Grinder and Tools

THIS dual-purpose rack prevents a small hand grinder from rolling off the bench and also holds the accessories being used at the time. It was made of $\frac{3}{8}$ " five-ply birch. The holes should be drilled not quite through the piece.—HENRY and RICHARD HANSCOM.



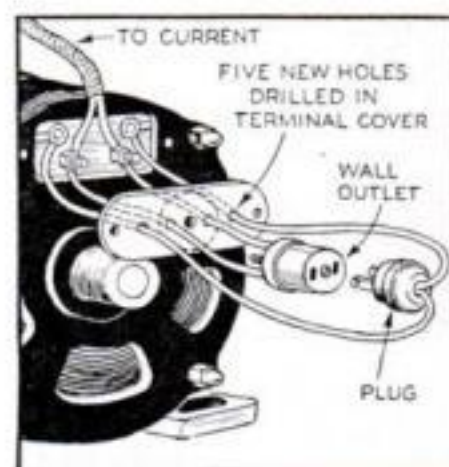
Scroll-Saw Blades Kept in Bamboo

WHEN a number of sizes of scroll-saw blades are kept on hand, good containers may be made from a bamboo pole. Cut it into suitable lengths as shown at left and cork the open end of each.—M. H. ARENDS.

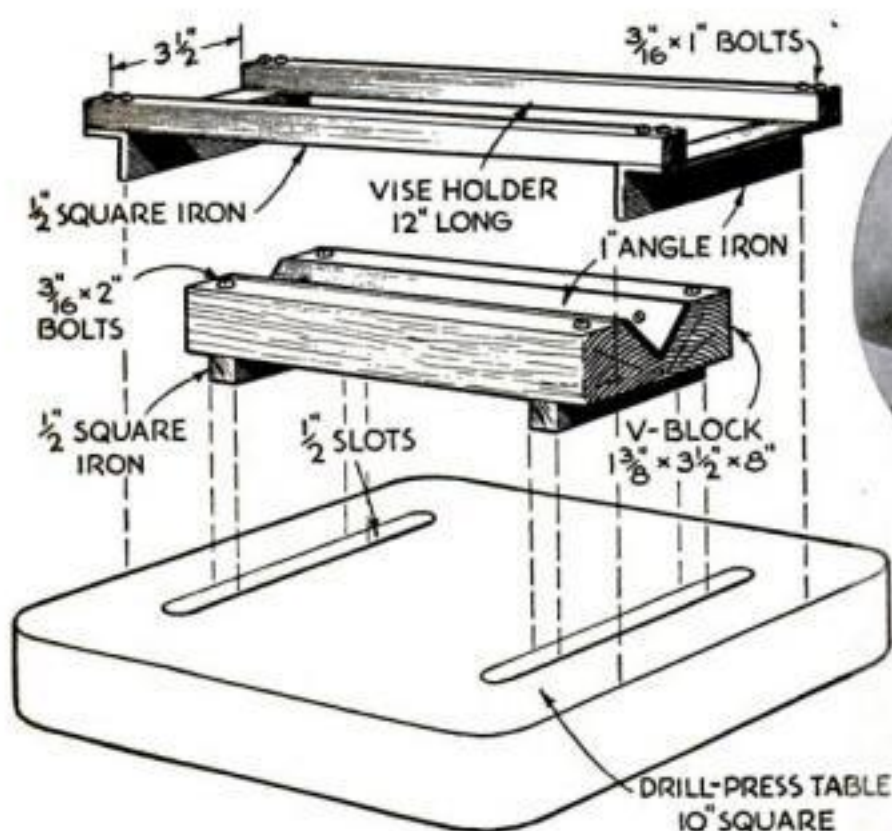
Ordinary Plug Reverses Connections on Motor

A REVERSING switch can be installed on a small split-phase electric motor by adding a wall outlet and plug as shown. To reverse the motor, the plug is merely pulled out, turned half way round, and reinserted.

However, wait until the motor stops before reversing the plug. Use heavy motor wire for the connections.

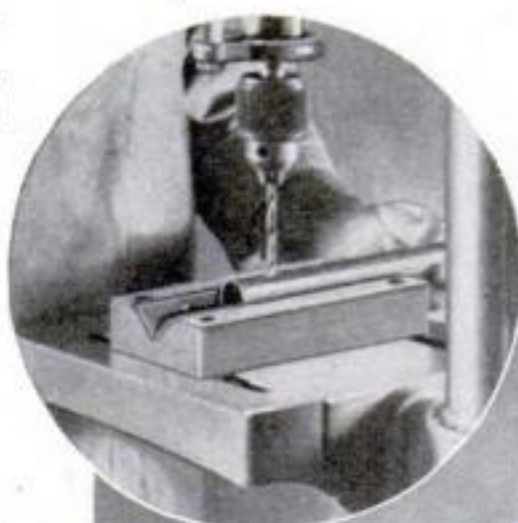


V-Block and Vise Holder Speed Drill-Press Work

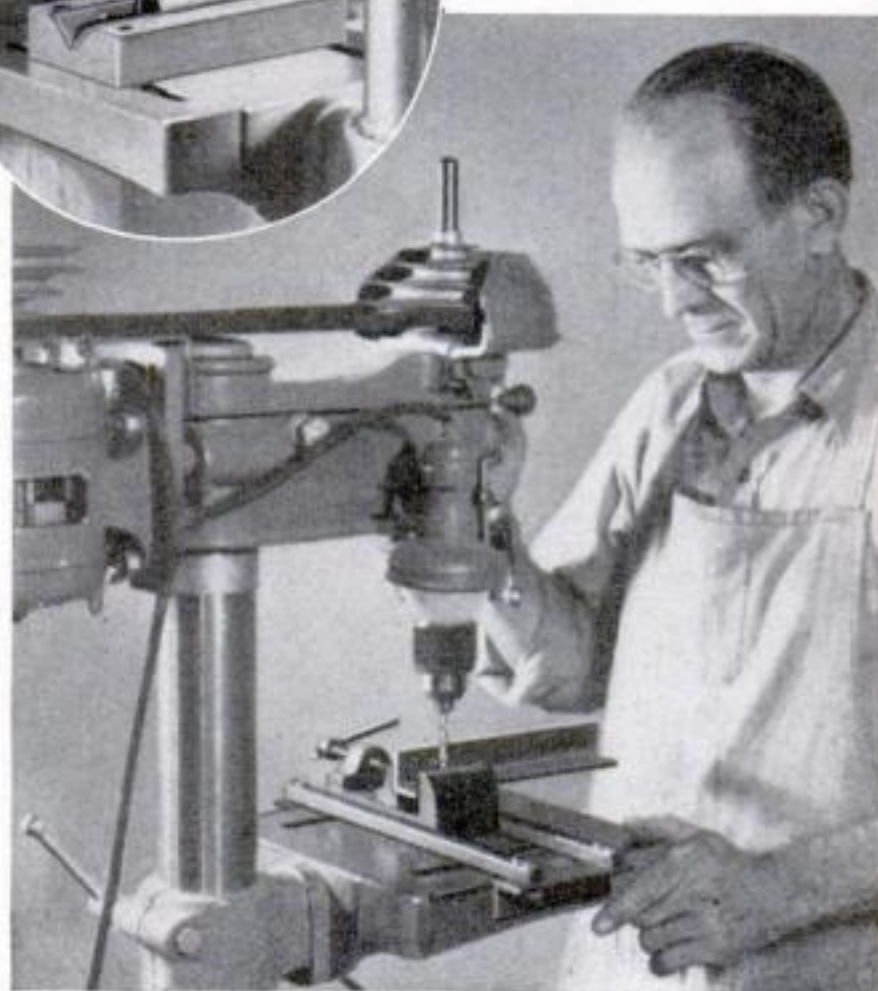


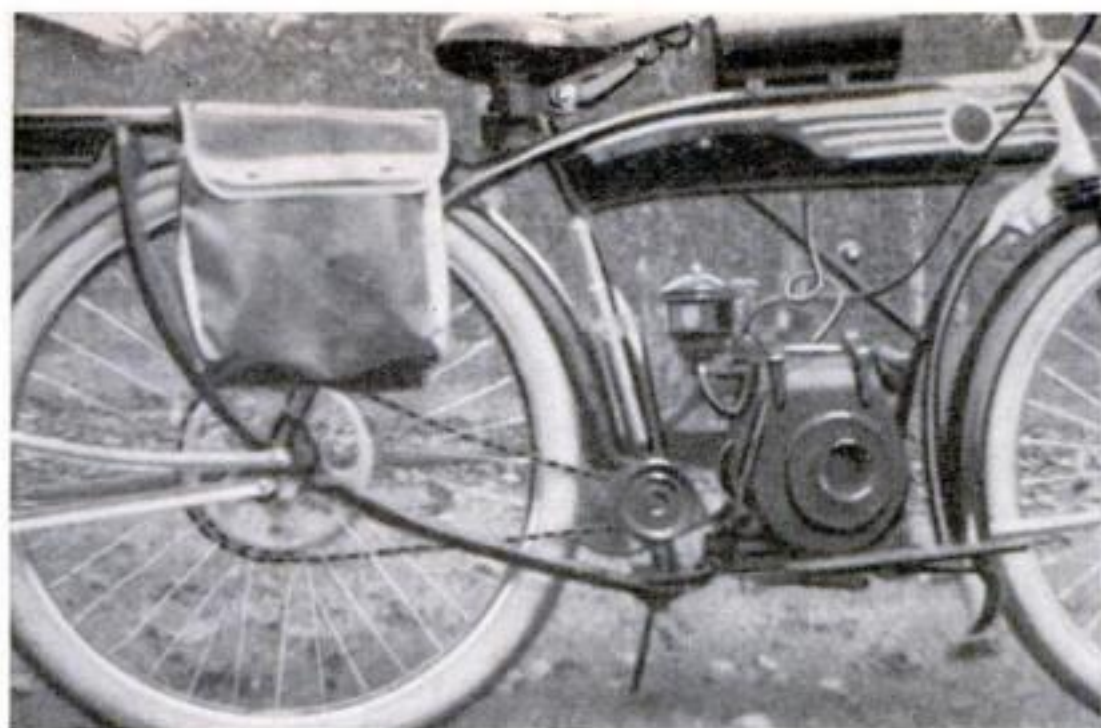
The vise holder grips the outside of the drill-press table; the V-block cleats fit in the slots

THE V-block and vise holder illustrated will aid in drill-press boring because it is then unnecessary to clamp the vise to the table while in use. The measurements given are for a drill press having a 10" table; however, the rods and angle irons can be cut to fit any size table or vise.—F. H.



Use of the V-block, as at the left, or the vise holder, as below, saves much time because no clamp is then required

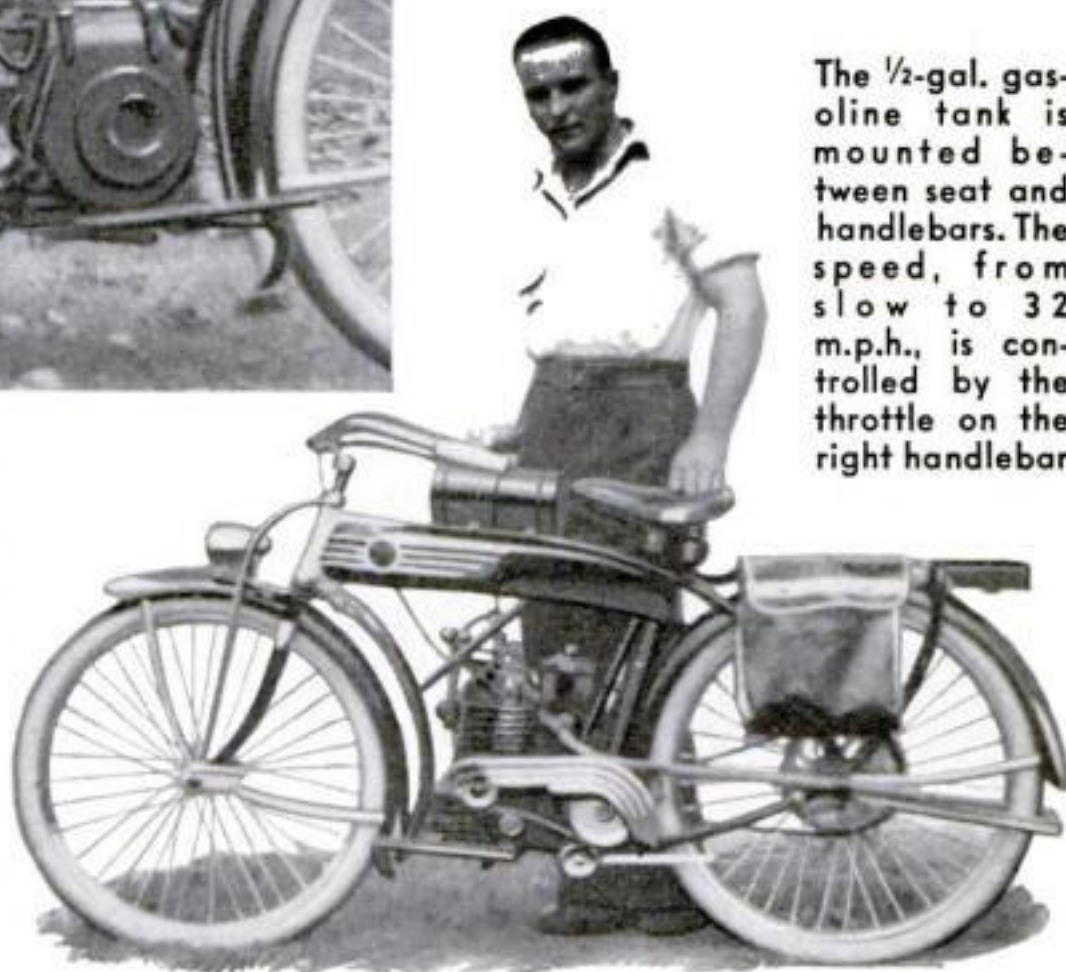




Power-Driven Bicycle

RUNS ON LITTLE GAS

The $\frac{1}{2}$ -gal. gasoline tank is mounted between seat and handlebars. The speed, from slow to 32 m.p.h., is controlled by the throttle on the right handlebar



POWERED by a high-speed $\frac{3}{4}$ -h.p. engine, this homemade "motor bike" travels 150 miles on a gallon of gasoline and will run 32 m.p.h. A double-frame bicycle with 26" wheels was used. I removed the pedals and crank, then cut the crank housing from the bicycle, bent the frame as required, and welded a piece of flat steel $13\frac{1}{2}$ " by 7" on a level about 3" lower than where the crank housing had been. This lowers the engine but still provides ground clearance.

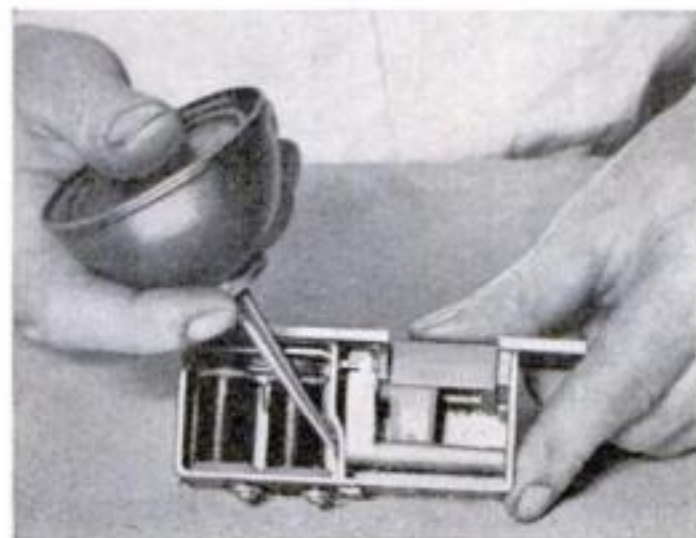
The engine is a lightweight, high-grade type originally purchased for use on a lawn mower. It develops $\frac{3}{4}$ h.p. at 2,100 r.p.m. and will turn 5,500 r.p.m. The drive ratio is about 10.4 to 1. The first drive is a $\frac{1}{2}$ " V-belt 28" long from a $2\frac{1}{2}$ " engine pulley to a $4\frac{1}{2}$ " idler-shaft pulley. The second drive is a $\frac{1}{2}$ "

pitch chain. The idler-shaft sprocket is 9-tooth, the rear-wheel sprocket 52-tooth. The brake is operated by the right foot, and will cause the rear wheel to slide; the clutch is a simple belt-tightening device controlled by the left foot. I also have a lever above the engine to pull up when I want to leave the motor running.—LEE E. SMITH.

DOOR OPENERS

[ELECTRICAL]

MOST failures of electric door openers are due to dirty or gummy mechanism. Remove the two wood screws that secure the opener to the door casing and pull it out carefully. Take off one of the side covers. Try holding the flat armature against the magnets and see if the striker can be pushed in easily.



Release the armature, and the striker should quickly lock again. While some one pushes the button, watch the operation of the opener. Cleaning the parts with a cloth damp with gasoline and then placing a drop of light oil on each moving bearing or pivot will usually remedy the trouble. See that the wires are properly connected at the back. Check the push-button contacts and wires for loose or dirty connections. Also examine the door to see if it is badly warped.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

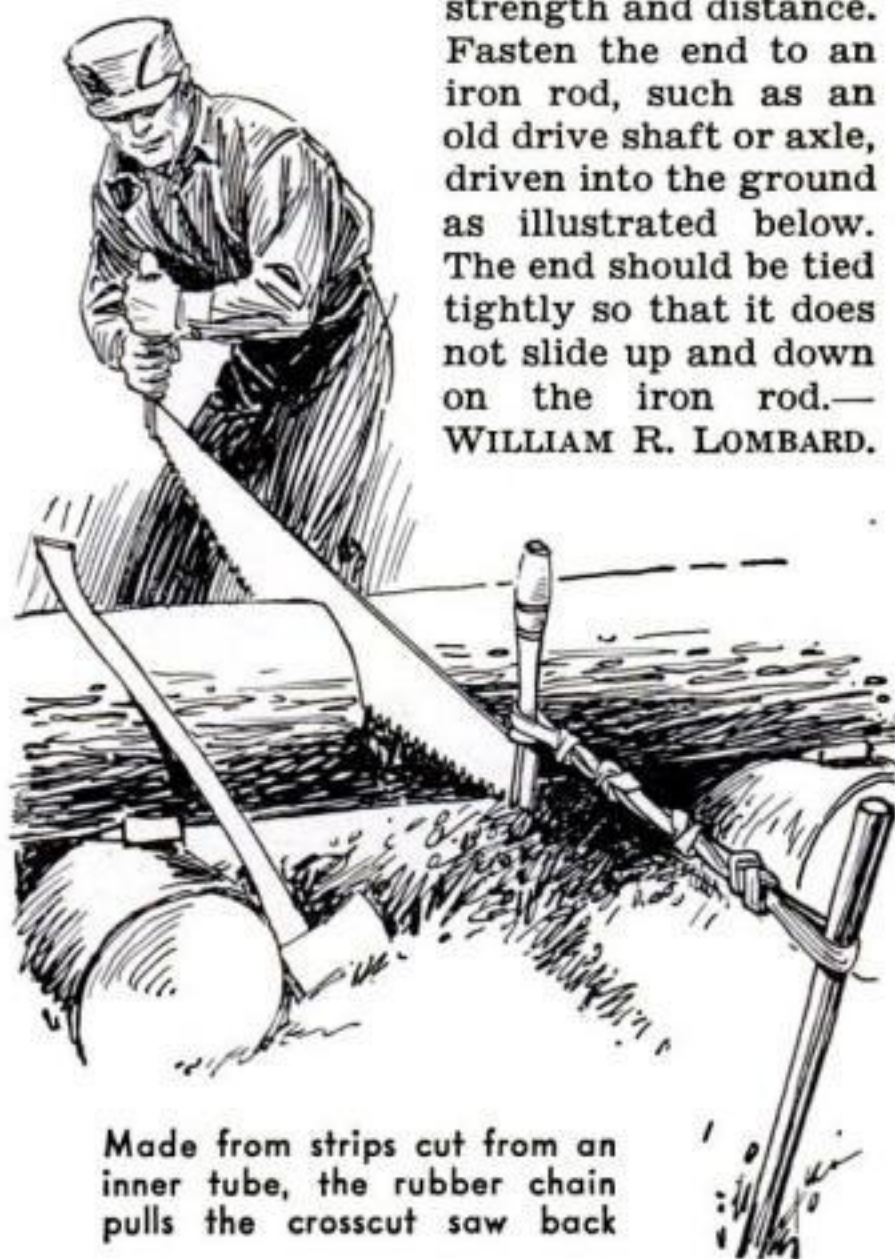


Electric Fan Blows Dust from Band-Saw Table

A SMALL electric fan will keep a band-saw table clear of sawdust during the cutting operations. The fan base is placed on a high stool near enough to the work to enable the breeze to blow away the dust. Instead of a stool, a shelf or bracket may be made for the fan base if this arrangement is used very often. Be careful not to place the fan too close.

How One Man Can Operate a Two-Man Crosscut Saw

WHILE it is not as easy as with two men, sawing can be done alone with a long two-man crosscut by using a rubber band on the opposite end to pull the saw back. A strong rubber chain may be made by linking bands cut from an inner tube. It takes some experimenting to get a band of the right strength and distance. Fasten the end to an iron rod, such as an old drive shaft or axle, driven into the ground as illustrated below. The end should be tied tightly so that it does not slide up and down on the iron rod.—
WILLIAM R. LOMBARD.



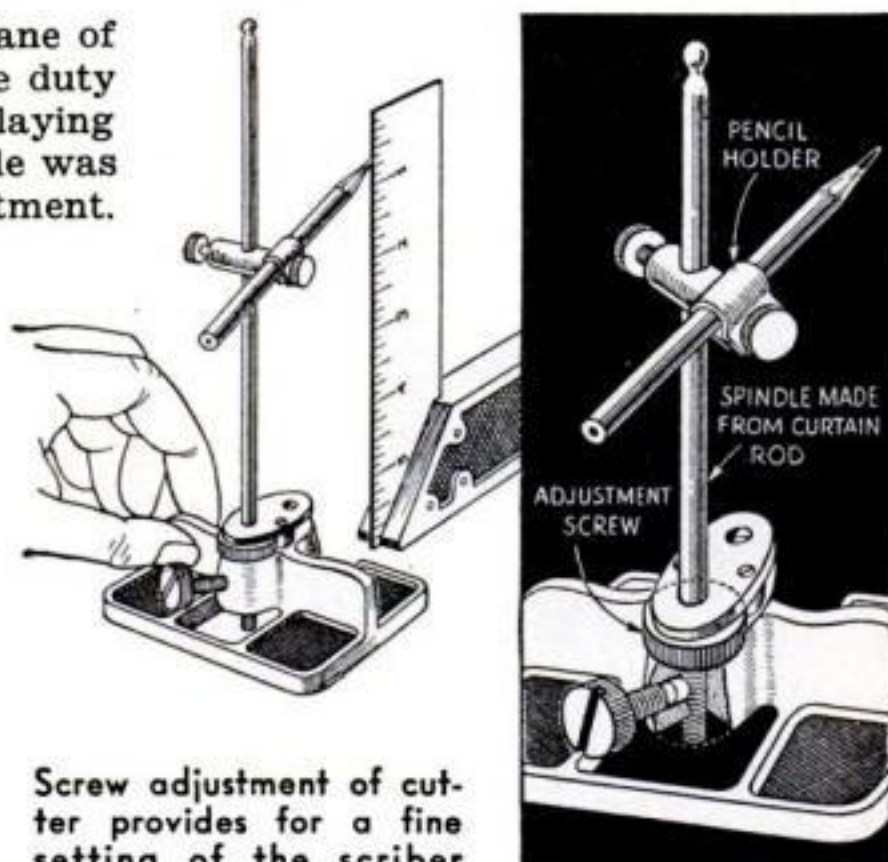
Made from strips cut from an inner tube, the rubber chain pulls the crosscut saw back

Router Plane Does Duty as a Surface Gauge

AMATEUR craftsmen who own a routing plane of the type illustrated can make it serve double duty as a surface gauge sufficiently accurate for laying out woodwork or art-metal work. The spindle was threaded at the lower end to give a fine adjustment. A retaining plate was fastened over the knurled adjusting nut to keep it in position. To protect the threads from damage, a short piece of brass rod was placed between the original cutter-holding screw and the surface-gauge spindle.

Applying Glue to Overlays

THE appearance of fretwork overlays is often ruined because glue oozes out from under them when they are attached to furniture. To avoid this, brush thin glue on a flat surface, press the fretwork against it, lift immediately, and apply to the work.

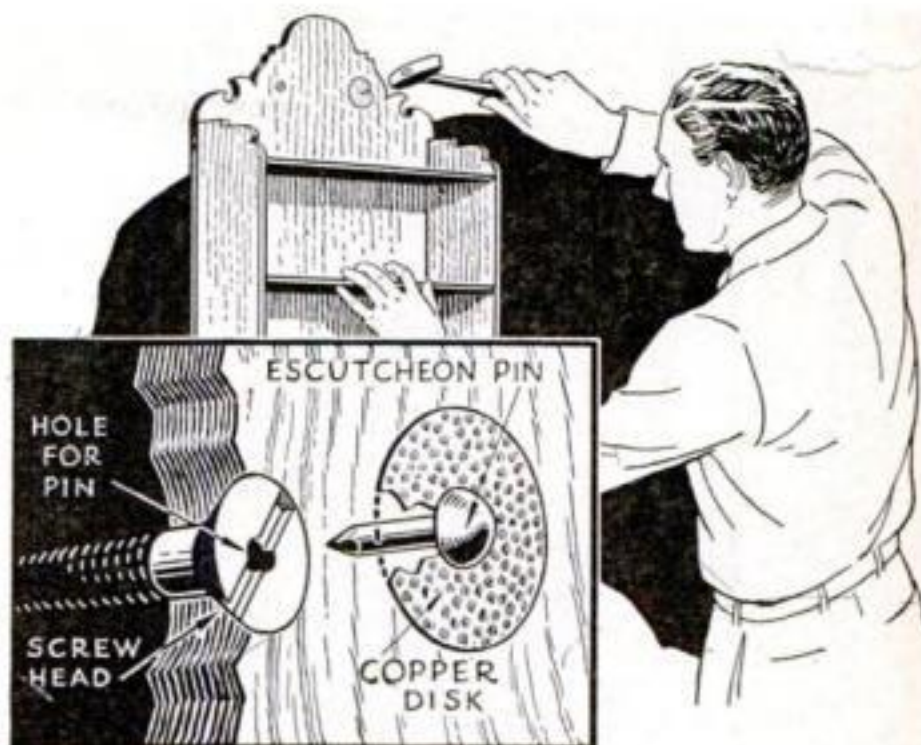


Disks of Copper Hide Unsightly Wood Screws

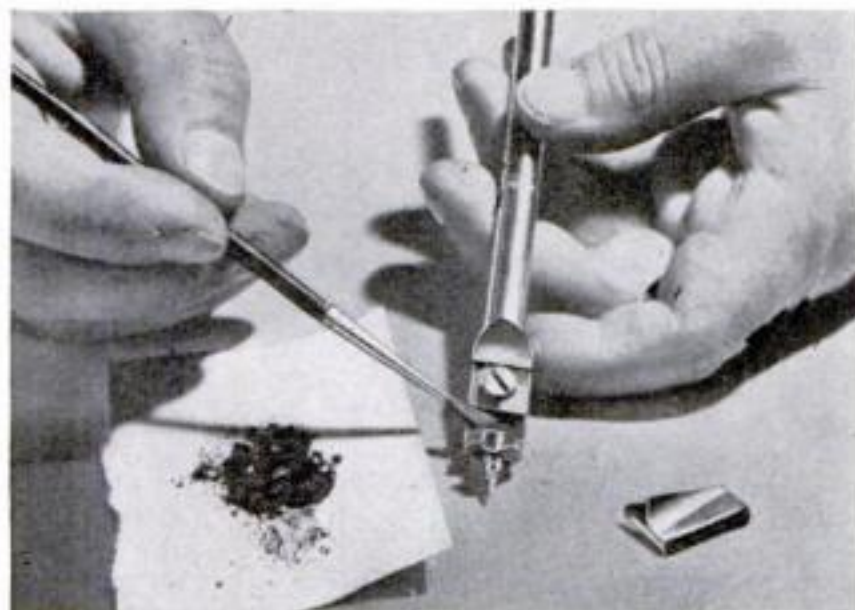
WHEN wood screws are used for hanging ornamental shelves and for other purposes and you wish to hide the unsightly screw heads, they can be disguised by the method illustrated.

A small disk of thin copper is punched out and drilled to pass a tiny brass escutcheon pin, and a corresponding hole is drilled in the center of the screw as shown. The latter is best done before the screw is fastened in place. The disk is then attached by driving the pin into the screw. To afford a tight fit, the pin should be flattened slightly beforehand.

These metal shields may be cut to any diameter (preferably a small one) or may be given other shapes if desired, and the metal may be hammered or ornamented in various ways.—S. J. GANCHER.



The pin is slightly flattened before being driven in



Scale Cemented to Lathe for Setting Calipers

CONVENIENTLY located on the tailstock of a wood lathe, this rule is handy for setting calipers to any diameter up to 4", which is usually sufficient for ordinary turning. It is

simply a small celluloid pocket rule cut down to a length of 4" and attached to the lathe tailstock as illustrated at the left.

Coat the back of the rule with waterproof cement, fasten it in place, and let it set overnight with a heavy weight placed on top of it to assure good adhesion.



Expansion-Bit Cutter Kept from Slipping

IF AN expansion bit is used for production work, particularly in a drill press, the cutter is likely to loosen and makes holes larger than intended. To prevent spoiled work from this cause, remove the blade and dust the end of the bit with a small quantity of fine emery or other abrasive. This will hold the cutter in position once the set screw has been tightened.—E. A. BOWER.

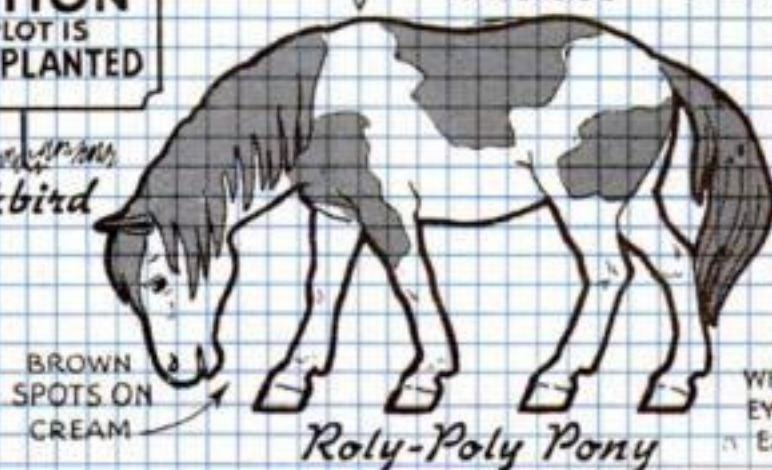
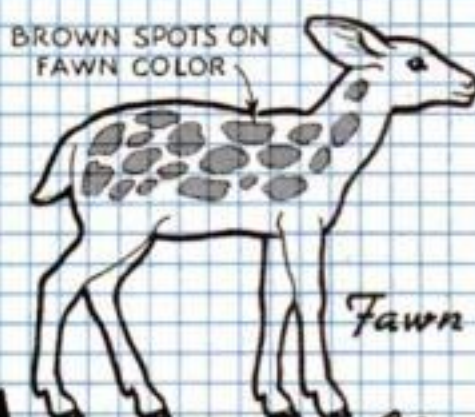
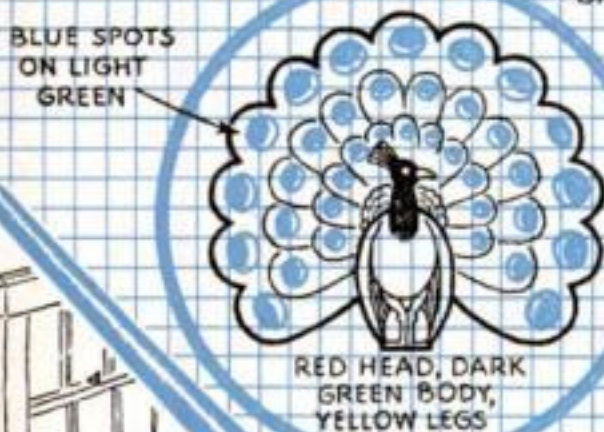
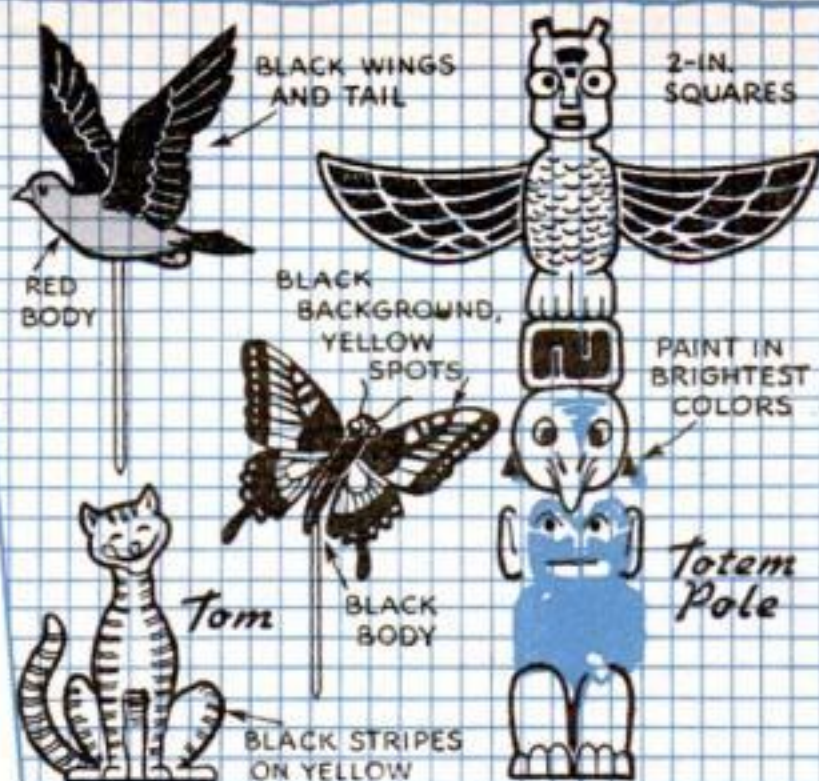


Soldering Acid Applied with Pipe Cleaners

ORDINARY pipe cleaners can conveniently be used to apply acid to work that is to be soldered. The cleaner is coiled at one end to form a tip, as illustrated above, and when not in use it can be hung on the neck of the bottle.—F. H. MEYER.

GARDEN MARKERS

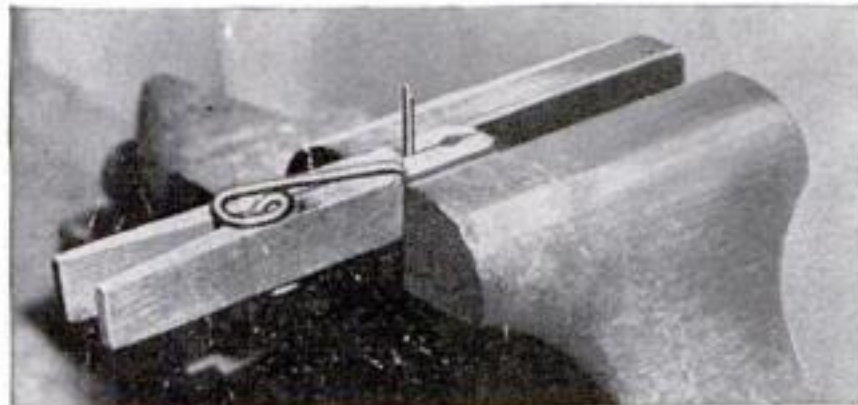
HERE are a dozen ways to dress up your garden. The squares shown are 2", but the figures may be made larger or smaller to fit the space available. Outdoor water-proof plywood is an excellent material; its thickness will depend upon the size of the marker. Braces may be required for the tall designs in addition to the iron stakes. Use bright paints and apply several coats. Careful painting is needed for the peacock—shade the blues into the greens.





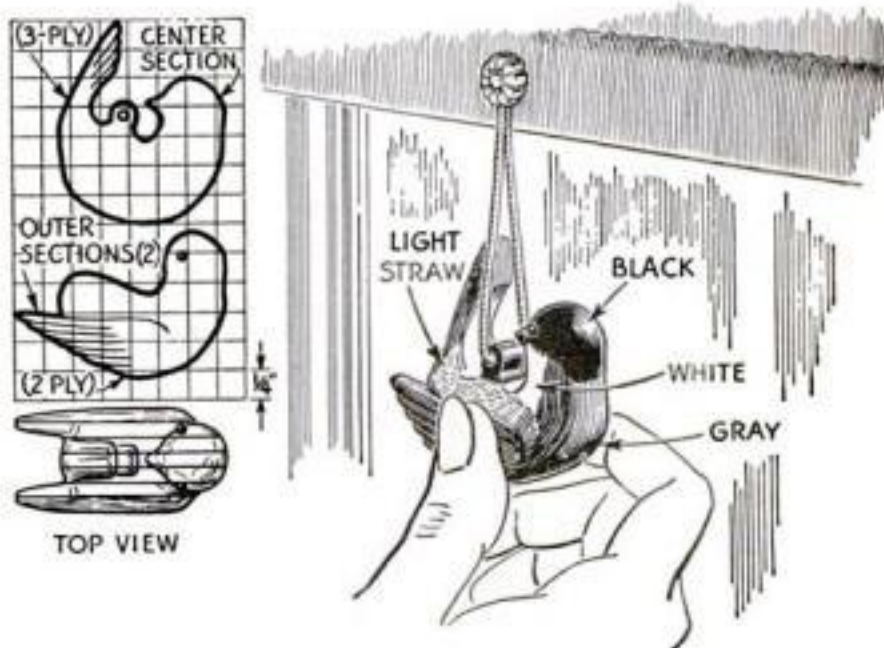
Cardboard Gives Support to Typewriter Paper

A COMMON nuisance while typing with certain small portable typewriters is the manner in which the loose ends of the paper hang over the back. To avoid this, I took a 5" by 10" piece of cardboard, cut a square hole in the middle about 2" from the bottom, and attached it to the paper rest of the typewriter with a small spring clip.—L. H.



Plywood Chickadee Acts as Novel Shade Pull

IF YOU have seen a chickadee feeding on the underside of a cedar branch, you will realize what a perfect model he makes for a window-shade pull. The center section is jig-sawed from three pieces of $\frac{1}{8}$ " thick gumwood previously glued together. The two outer sections are cut from a piece glued up from two plies of $\frac{1}{8}$ " gumwood. Color the top and back of head, throat, and feet, black; sides of throat, white; breast and sides of body, light straw; and the back, wings, and tail, gray.—EDWARD B. FOX.



Holding Delicate Parts in a Bench Vise

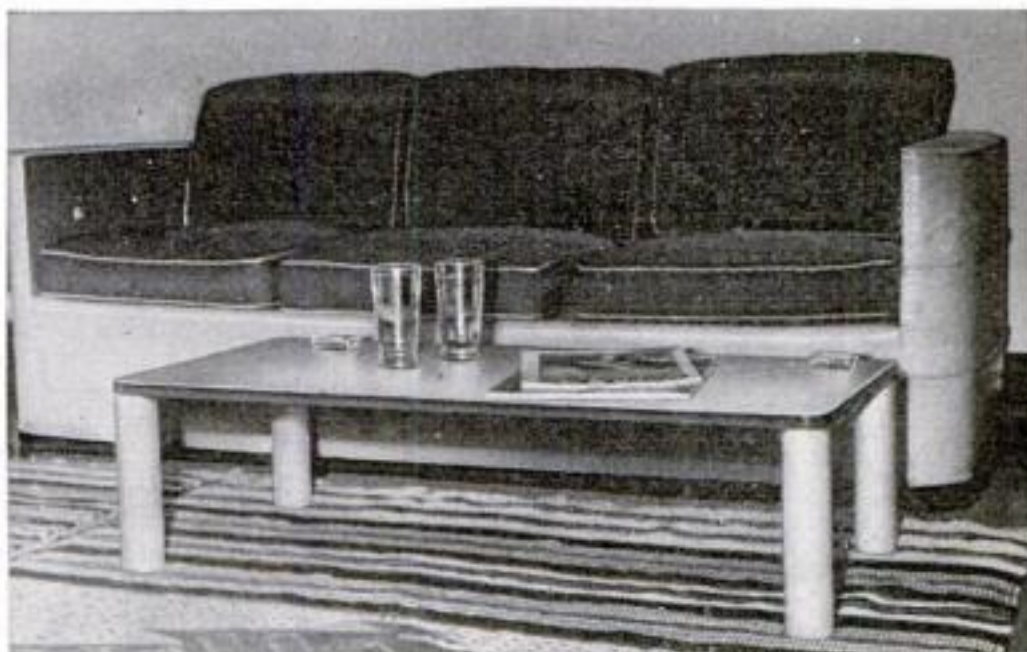
DELICATE parts may be held firmly without damaging their finished surfaces, threads, or sharp edges, by gripping them between the jaws of a spring wooden clothespin and clamping the clothespin in the vise.

Durable Cocktail Table Has Rolling-Pin Legs

ROLLING pins form the legs of the modern cocktail table illustrated. Hard maple pins 10½" long were selected; they can be found in plain or birdseye grain. It is necessary only to remove the handles. The top, which is 20" by 42", was cut from $\frac{3}{4}$ " plywood. The corners were rounded, and the legs screwed on after holes had been drilled.

Cream-colored leather substitute was then fastened to the top with linoleum cement. This covering was rubbed with an alcoholproof varnish of the type that can be wiped on. The edge of the top was painted with blue lacquer. The legs require no finishing, not even wax, because they are so hard and beautifully turned and polished. They

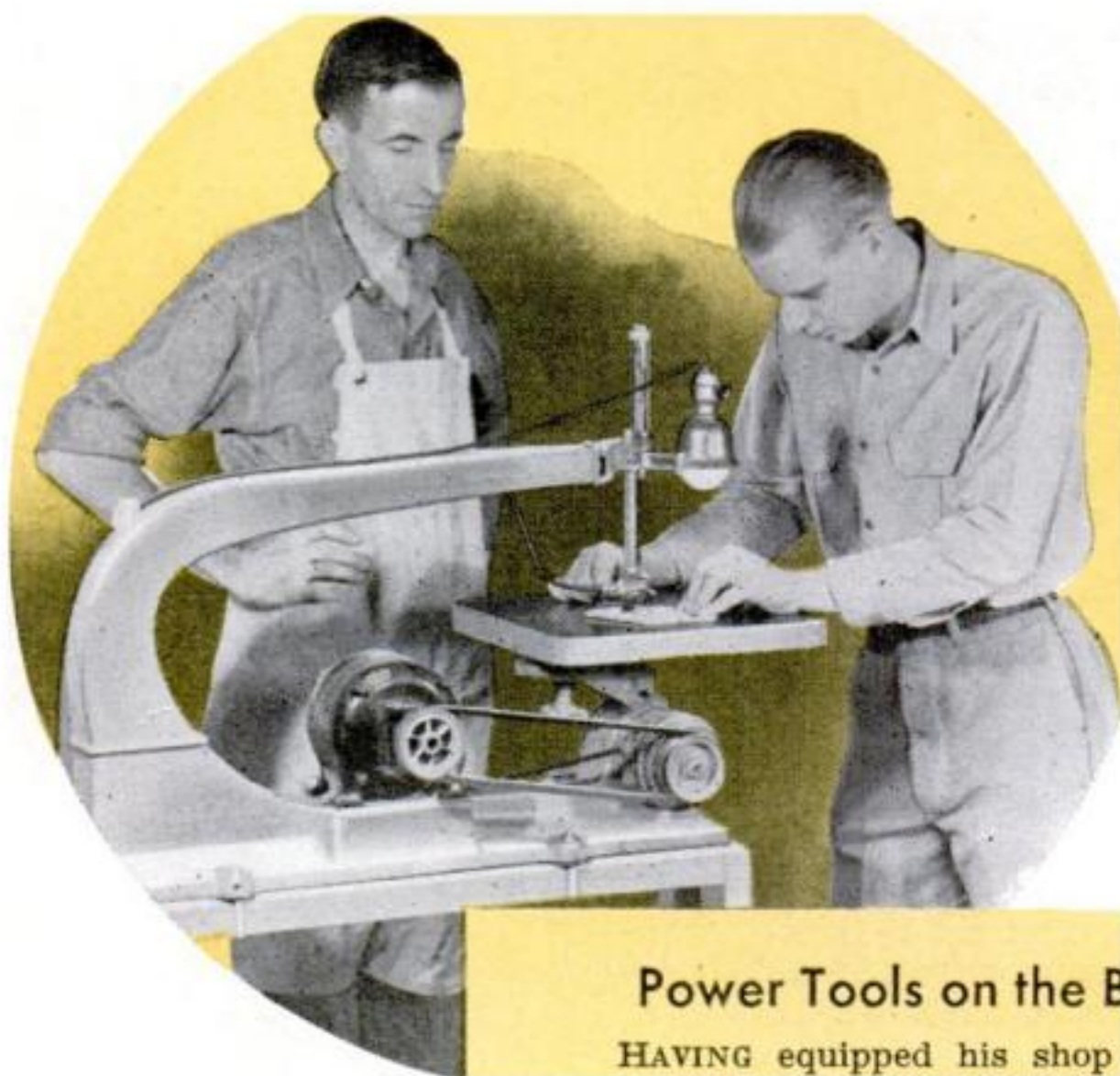
will stand rough usage without becoming marred, and the table is good for years of service.—GEORGE CHATTERTON.



What Machines Shall I Buy

PART IV
OF A NEW
SERIES FOR
BEGINNERS

BY
EDWIN M.
LOVE



Power Tools on the Budget Plan

HAVING equipped his shop with hand tools, Robert Jaacks, Mr. Love's young friend, is now considering the purchase of woodworking machines. He spent several enjoyable hours trying out various power tools and then decided to order an 8" circular saw and 4" jointer mounted on a combination stand and operated by a $\frac{1}{2}$ -h.p. motor, as well as a 24" scroll saw with stand and motor. He can make the down payment of less than \$30 by saving his budget allowance for two months, and the budget will also meet the later monthly payments, which are under \$15.

POWER tools have revolutionized the home workshop within comparatively recent years and opened an immensely wider field to the amateur craftsmen. Fifteen years ago some small woodworking machines were available, but the good ones were expensive and the cheap ones were of a quality to discourage even the most ardent enthusiast. Now a large variety of exceptionally well-designed, versatile power tools are available, and the principal difficulty the beginner experiences is in deciding just which ones will best serve his own particular purposes.

The questions and answers in this article will help to point out the way toward a wise choice; and then if the beginner will study the many excellent and informative catalogues offered by manufacturers of home workshop equipment and spend a little time examining machines in hardware stores and the larger department stores, or in the shops of his friends, he will be able to make an intelligent selection of tools that will give lasting satisfaction.

In a fairly complete home workshop, what machines are needed?

This naturally depends on the hobby the owner wishes to follow. For the average type of woodworking, these should be enough: Circular saw, jointer, scroll saw, wood-turning lathe, drill press, band saw, and their essential accessories. A still more complete assortment might include a metal-turning lathe, a spindle shaper, sanding disk or belt, and grinder.

What work are these designed for?

The circular saw is largely used for getting out stock, that is, roughly sizing lumber and cutting it to length. With proper

for My Home Workshop?

blades, it can rip wood smoothly enough to make glue joints without further treatment; and tenons, as well as other joint members, can be cut with great accuracy. Special cutting heads are available to do rapid grooving and to shape moldings on straight edges or outside curves. With an abrasive wheel in place of a saw blade, metal, tile, porcelain, and similar materials are neatly sliced.

A small jointer smooths wood up to 4" or 6" in width, straightens edges of lumber, cuts rabbets, chamfers, and so on.

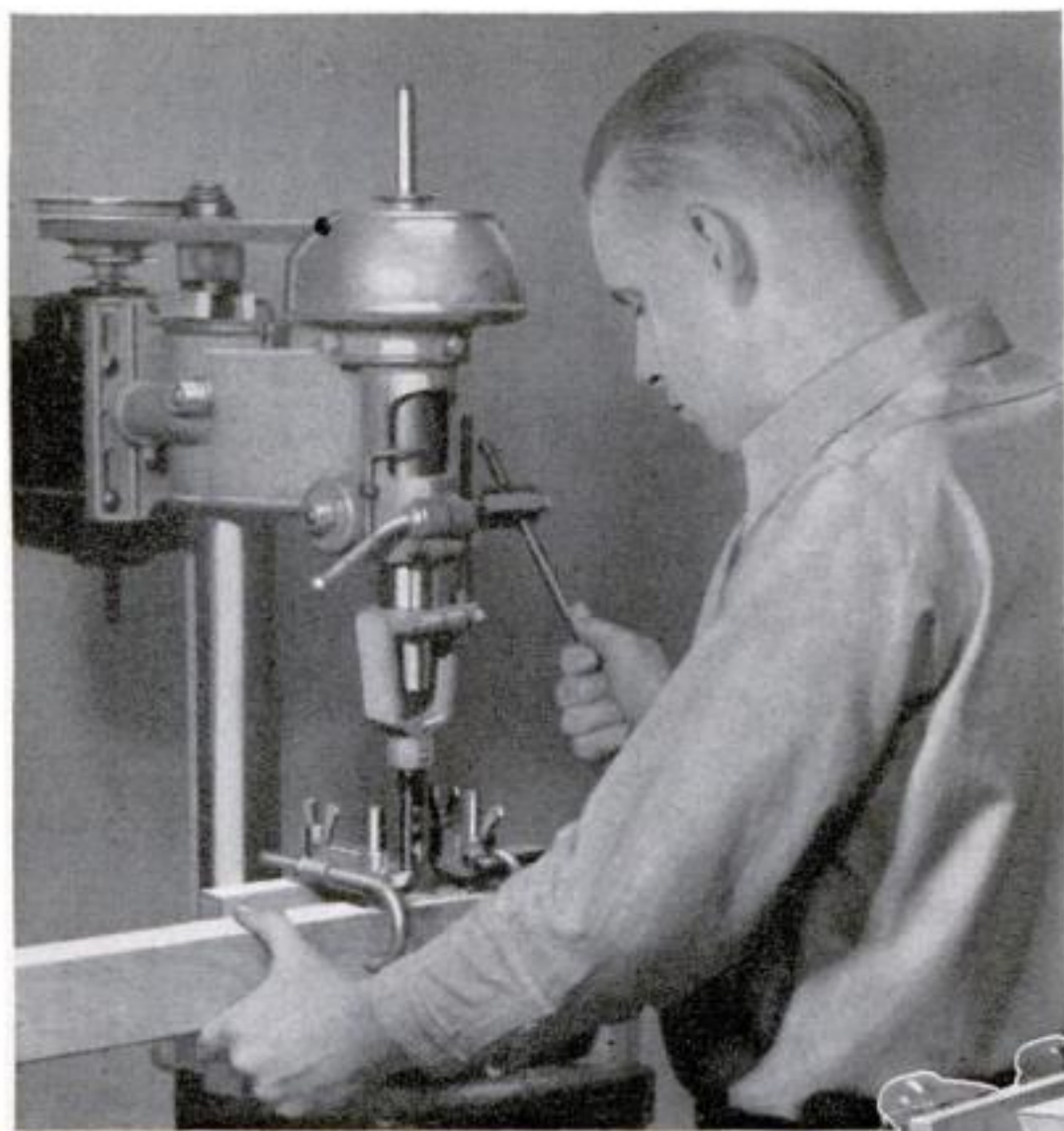
A scroll saw makes curved or straight cuts in wood up to 2" in thickness, and soft metals up to $\frac{1}{4}$ ", and takes sanding accessories and files for smoothing the edges. Its particular job is to work inside holes where

other types of saws cannot be manipulated.

A wood-turning lathe is used for shaping wood in the round—spindles, such as table legs; faceplate work, such as bowls and rosettes. Sanding disks and drums increase its usefulness; a drill chuck makes boring possible, and with the aid of a compound tool rest, light metal turning can be done. Grinding is a common use, as well as metal finishing with scratch brushes and polishing buffs.

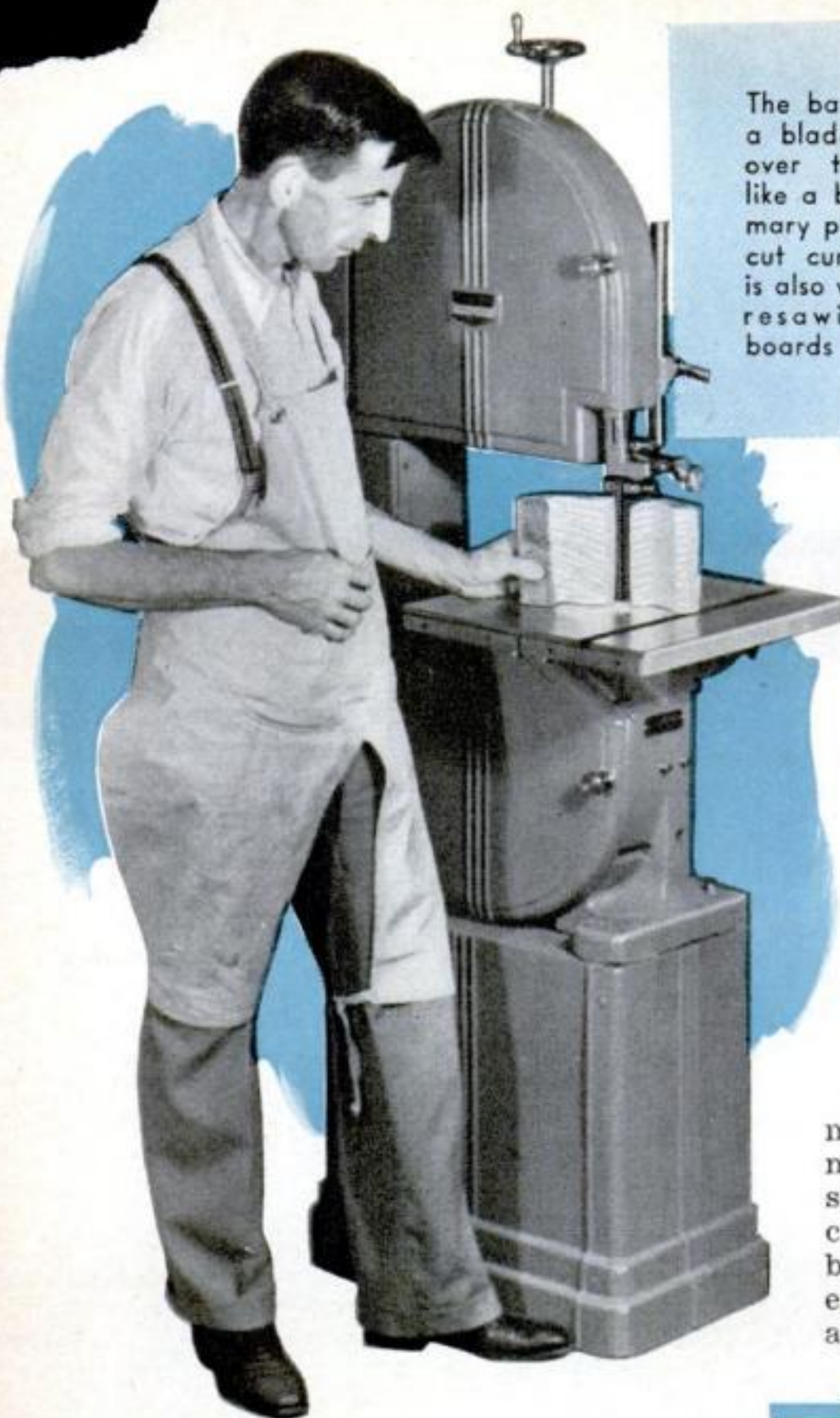
A drill press is primarily for boring holes; but with accessories it makes mortises, routs out recesses, and efficiently shapes moldings on wood edges, curved or straight. Rotary files, carving bits, sanding drums, and certain grinding wheels greatly extend its usefulness in the home shop.

A band saw is a machine with a beltlike blade that will cut curves in thick material



Above, Jaacks is trying out a mortising attachment used with a drill press. This is a labor-saving device if much cabinetwork, doors, screens, and sash are to be made. Right, using a jointer to cut a rabbet along an edge





The band saw has a blade that runs over two pulleys like a belt. Its primary purpose is to cut curves, but it is also valuable for resawing thick boards into thin

wood when required.

A spindle shaper cuts moldings, grooves, and rabbets, and the elaborate "lock" joints sometimes used to put chests and drawers together with.

A grinder is mostly used for rapid and rough grinding of tools, preliminary to honing. It is a good machine for trimming castings and forgings, and other rough shaping of metal parts. Oilstone wheels are obtainable for fine honing.

These machines all appear to be so useful, how can one decide?

Machines must be selected to fit the chosen hobby. It is rather foolish to buy one that is rarely used, and wasteful of time and labor to put off getting one that really is needed. The average home shop enthusiast starts with the circular saw, adding the others more or less in the order listed before.

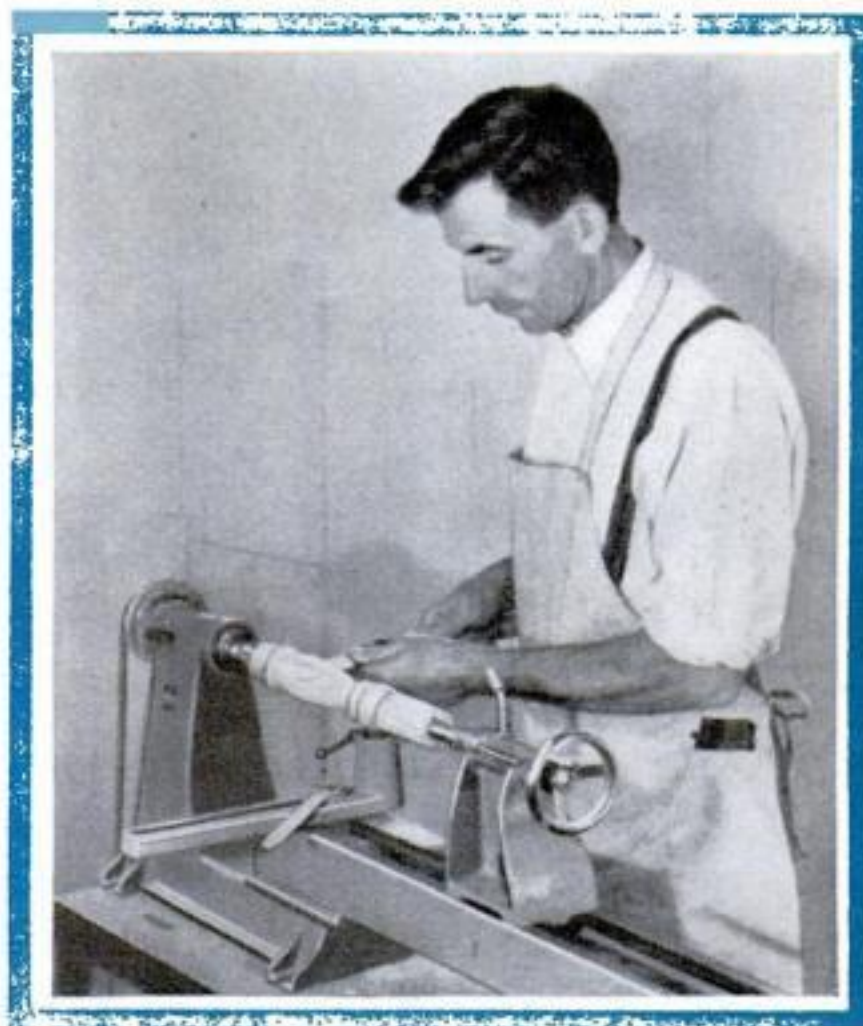
If a man is especially interested in fret-saw work, certain model making, saw-pierced metal work, or metal filing, he may start with a scroll saw. If need arises, he can rip and cross-cut boards faster and easier than by hand. If he likes to assemble projects from stock sizes of wood and metal, or has much curve cutting in heavy

up to 12"; resaw thick boards into thin, and cut veneers from billets of fine wood. Equipped with a slow drive, it cuts rapidly through all sorts of metals. Since the blade moves faster than that of a scroll saw, with the teeth continually passing downward, it saws more rapidly. It will even do inside cutting by sawing through from the outside, if the necessary filling of the entering kerf is not objectionable in the work.

What about the other machines mentioned?

These are specialized, for use where much work of a given kind is to be done. A metal-turning lathe, designed for such work as turning shafts, cutting threads, and boring, is really quite versatile when fitted with accessories for surfacing, grooving, and grinding. It will also turn

Perhaps no machine tool gives an amateur more pleasure to operate than the wood-turning lathe. Here Mr. Love is turning a spindle



lumber, he might buy a band saw with a fast-slow drive. Again, the fascinating hobby of wood turning may claim attention, calling for a lathe.

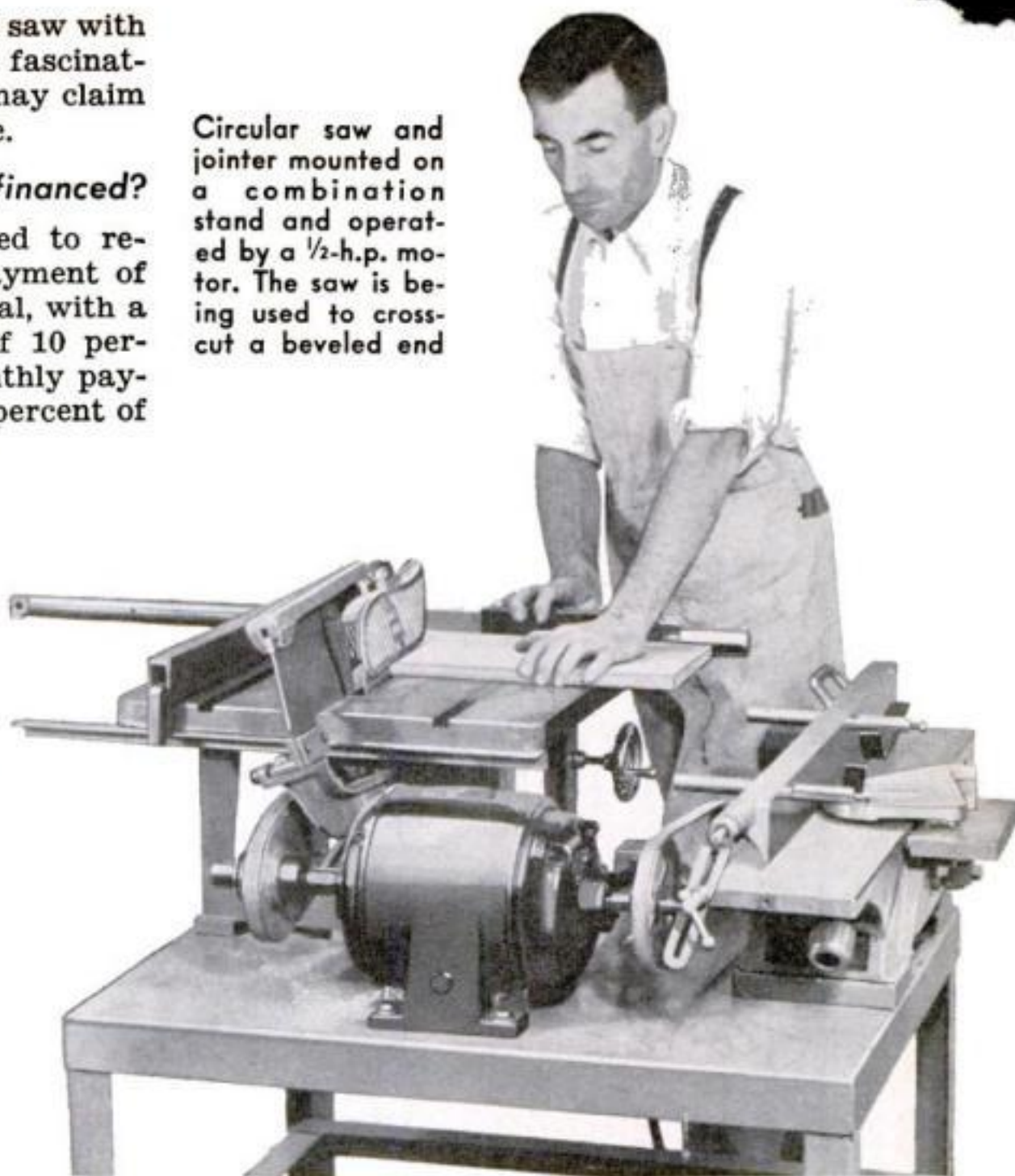
How can the purchase be financed?

Time payments are offered to responsible buyers. A first payment of from 20 to 30 percent is usual, with a probable carrying charge of 10 percent on the remainder. Monthly payments may be from 6 to 10 percent of the amount outstanding. For example, one manufacturer has this listing: 8" circular saw, 4" jointer, and 24" scroll saw, all with individual motors and stands; 11" lathe with motor, 11" drill press with motor; total price, \$258, with a down payment of \$85 and monthly payments of \$17.50.

By omitting stands, the cost is reduced about \$18. If motors are not ordered, but used motors are purchased locally, a saving of 40 percent, totaling about \$30, may be effected. Still further saving is possible by using one motor and a line shaft, or a portable motor mounting.

Machines of home workshop size, like those mentioned above, are priced something like this: Circular saw, \$20 to \$35; jointer, \$14 to \$30; scroll saw, \$5 to \$30; lathe, \$15 to \$35; drill press,

Circular saw and jointer mounted on a combination stand and operated by a 1/2-h.p. motor. The saw is being used to cross-cut a beveled end

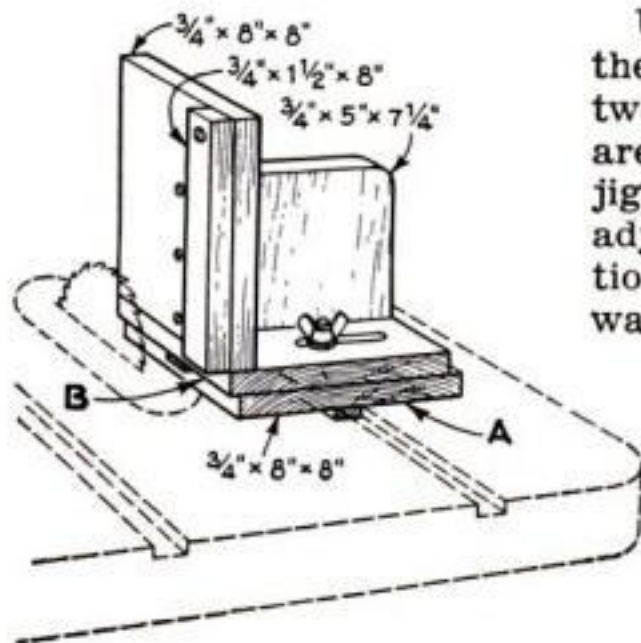


about \$25; band saw, \$16 to \$50 (10" to 14"); metal-turning lathe, \$125; spindle shaper, \$20 to \$30; grinders, all prices.

(TO BE CONTINUED)

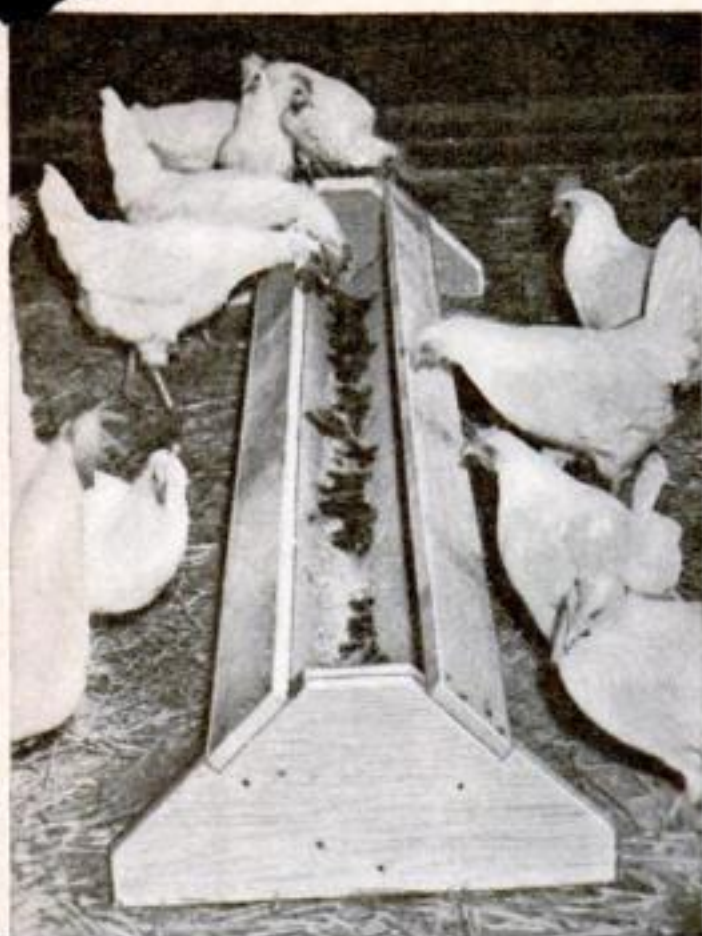
TENONING JIG FOR CIRCULAR SAW

[WOODWORKING]

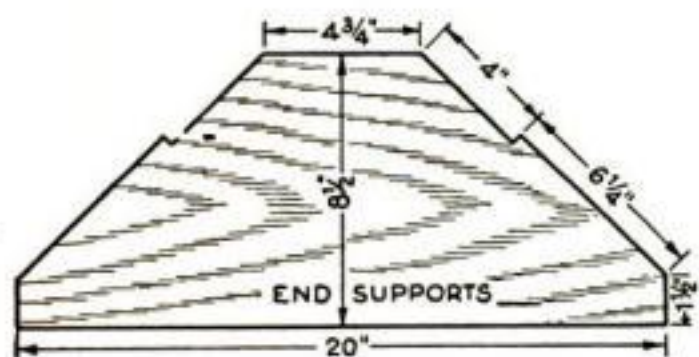


Use hardwood or preferably five-ply. Screw the parts together and give the jig a coat or two of boiled linseed oil. Pieces to be tenoned are held with a C-clamp against the face of the jig. The bolt in base A is loosened, and sidewise adjustment made until the saw blade is in position for cutting a tenon side, with the kerf in the waste wood. A metal or hardwood tongue screwed under base B and sliding in a slot in A keeps the assembly square in any position. A similar tongue on base A slides in the saw groove and guides the jig past the saw. When one side of the tenon is cut, shift for cutting the other side.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



Long hoppers provide adequate space for all the chickens to eat at once. Below, diagram of the end supports

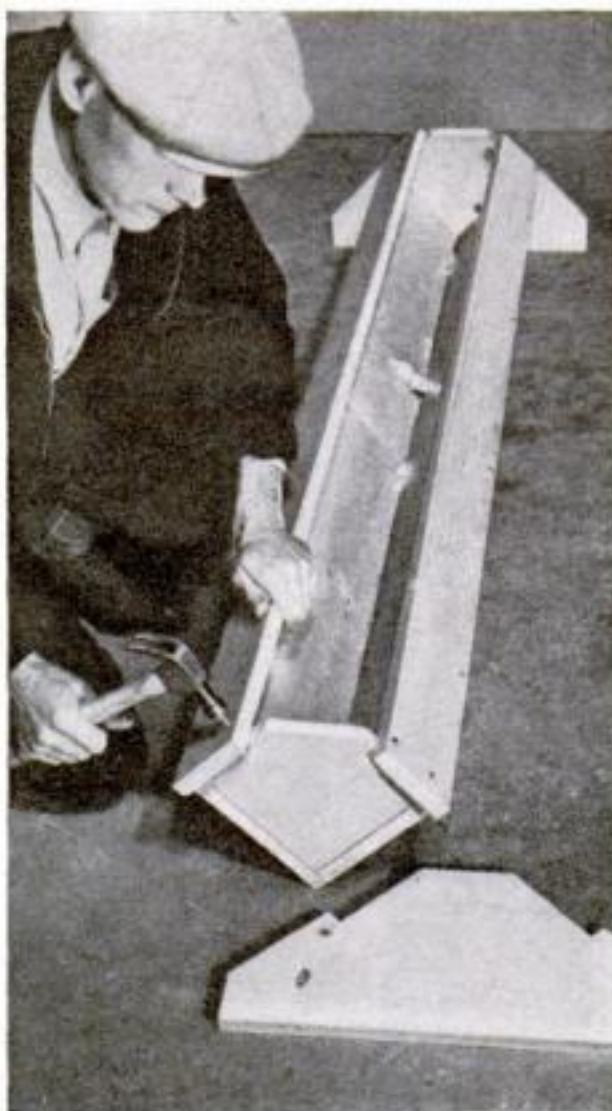


Wooden Floor Hoppers Save Money for Poultrymen

CHICKENS are often injured or at least kept in a chronic state of fright because of the type of hoppers used in poultry houses, and this seriously reduces the poultryman's profits. If hoppers like the

one illustrated are provided, crowding, pecking, and fright may be avoided. They are easily made and cost very little. The end supports are cut to shape as shown. The boards forming the V-shaped trough are 5' 8 1/2" long, one 7" and the other 6 1/4" wide. The top strips, 3 1/2" wide and 6' long, fit into cut-out places on the end supports.

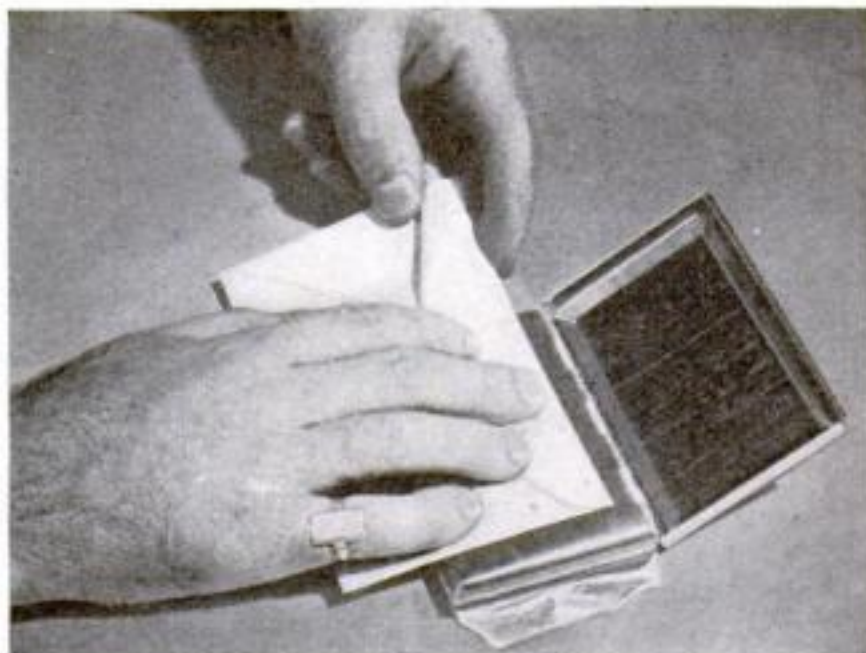
All floor hoppers should be placed with one end towards the light to prevent litter being scratched into the feed, as chickens face the light when scratching.—B. N.



Pipe Cleaners Remove Cuttings from Dies



AN ORDINARY pipe cleaner is a great aid in cleaning thread-cutting dies, especially of the smaller sizes. The die is dipped in oil, and the cleaner is passed through the openings to remove the cuttings. Dies should be well oiled after use.



Inexpensive Substitute for a Rubber Stamp

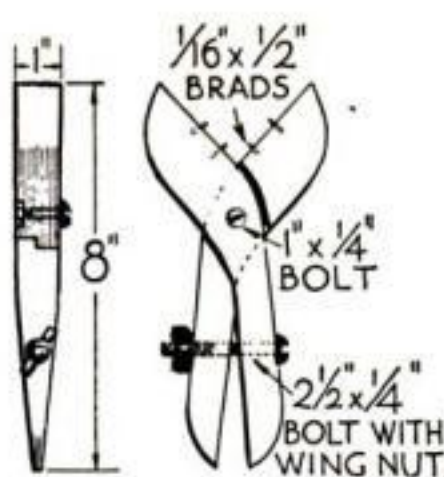
FOR printing your name and address, a stamp pad can be converted into a self-inking "stamp." Type or write the matter to be duplicated on a small piece of duplicator stencil, then place it face downward on the pad, holding the edges with a rubber band. In use, merely lay fresh sheets of paper on the stencil and press into contact.—K. M.

Ammonia Bleaches Iodine Spots

TO CLEAN iodine spots from white cloths, pour on strong household ammonia, roll up tight, and leave in a dry bathtub over night. Rinse out with clean water and hang in the sun to whiten the garment.



Use a jig to cut the slot in the frame for the spline



Special Clamps Squeeze Picture-Frame Joints

PICTURE frames can be glued together with wooden jaws or clamps resembling large pliers. They are made as illustrated to the right above. The two wooden parts are shaped from pieces 1" by 8", and a 2½" by ¼" bolt is inserted through the handle so that the wing nut can be tightened to keep the pliers firmly in place.

After the glue dries, cut a saw slot in each corner for thin wooden splines or reinforcing pieces. To aid in doing this, a jig should be used as shown. It is merely a board with



two strips screwed on at right angles to each other.

Cut the splines from 12" to 24" in length and thick enough to fit snugly in the slots, then cut them to the length wanted. Glue them in the corners, let them dry, and trim them off flush so that the frame can be finished.—RUDOLPH KNAUS, SR.

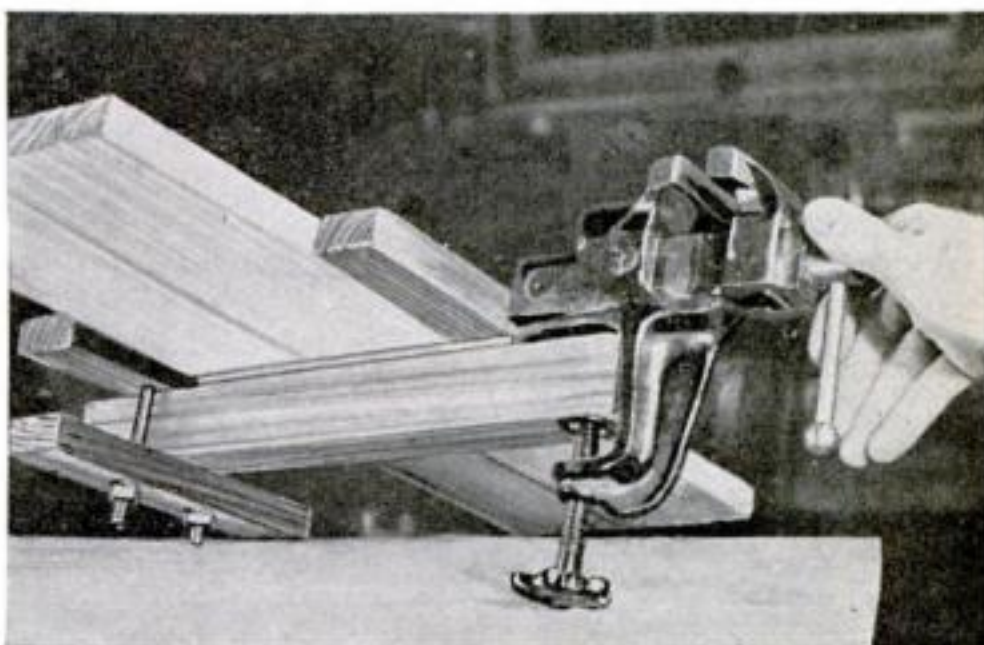


Red Reflector Buttons Protect Dog at Night

SEVERAL small red reflectors of the type commonly used for fastening license plates to cars are a protection to a dog at night if fastened to his harness as shown above. When he crosses in the path of a car, the red buttons reflect the light of the headlights and serve as a warning.

Bar Clamp Easily Improvised from Small Machinist's Vise

A SMALL vise of the machinist's type can be quickly made into a serviceable bar clamp by fastening it to the end of a suitable length of 2" by 2" wood, as illustrated below. Small pieces of hardwood bolted at right angles to this bar at the proper distance serve as a stop; and the slide on the vise, when the screw is tightened, exerts pressure against the pieces of wood that are to be glued together.—LOUIS A. LEMBACH.



Pieces of hardwood bolted to the bar serve as a stop, and the vise slide pushes against the wood to be glued

By EDWIN
G.
GETTINS



Now Anyone Can Try **TANK FARMING** *on a Small Scale*

YOU may be one of the many who have become interested in soilless culture, but would like to try it on a very small scale at first. The apparatus illustrated fills just such a need. It is an adaptation of standard laboratory practice, using the drip method of Dr. John W. Shive. It can be used in a hothouse or outdoors through the summer, and not only one plant, but a whole battery of growing jars may be fed from a single supply bottle.

In working the glass tubing, hold it about 12" above a gas flame till the glass heats up, then lower it gradually into the direct flame. First a bend is made in one end, but allow enough room at the short end to hold on to it while the glass gets hot enough to bend. Cut off the short end so that it will correspond with the drawing. To cut glass tubing, make a notch with a sharp file at the point desired and snap like a twig. Cut the long end to leave 6" of straight tubing.

Hold the remaining piece of tubing at each end and heat the middle. When it begins to glow, pull each end, and the center will draw down. Continue pulling until there is only a threadlike piece of glass joining the two halves, then separate with a quick jerk. Wave the two pieces about until they cool. Break or grind off the pointed end of one of the pieces until one drop of water a minute will drip out of it when it is fitted to the siphon piece with the rubber hose. Prop the tube on rests as shown.

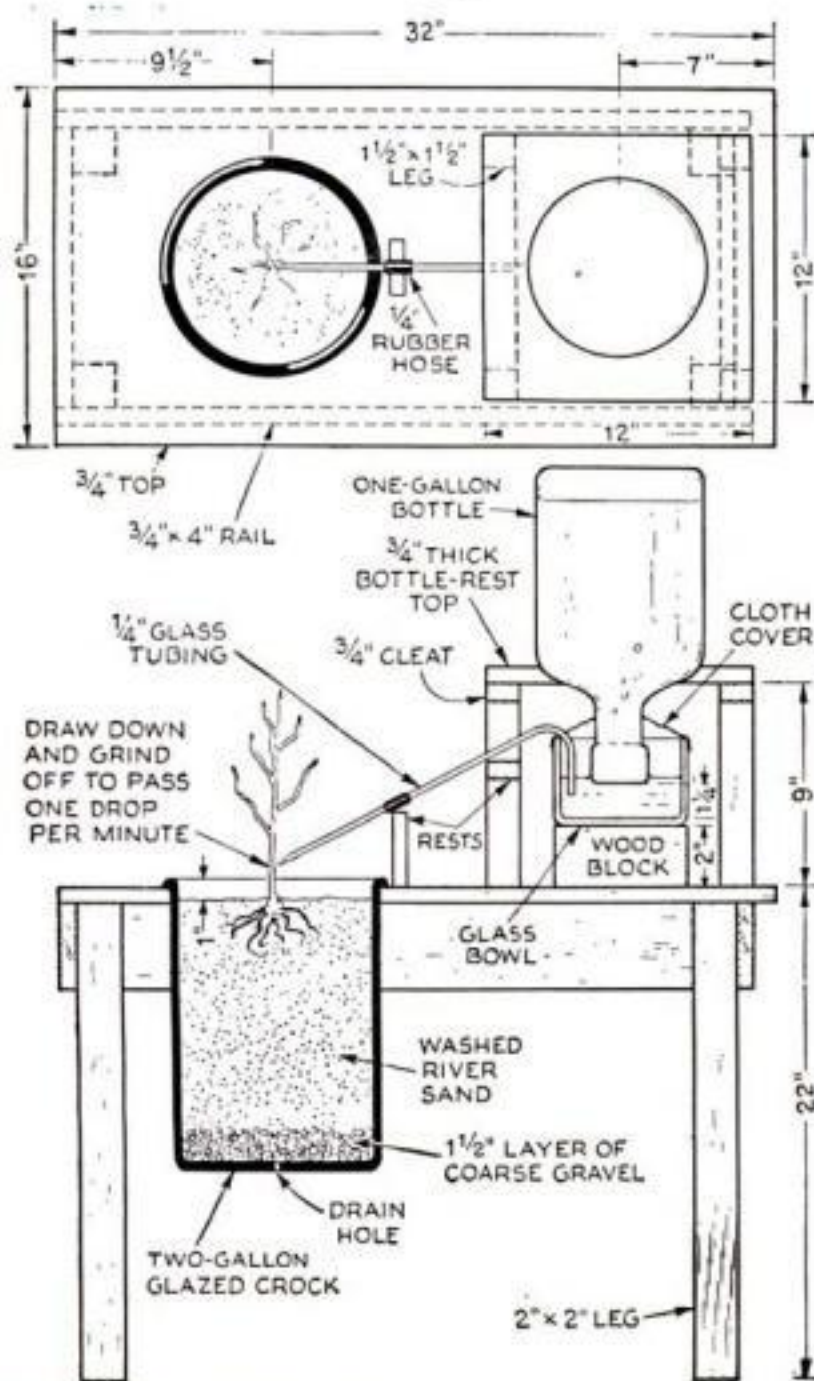
Drill or punch a drain hole in the center of the bottom of the crock. Put in about a 1½" layer of pebbles or coarse river gravel and fill to within 1" of the top with washed river sand. Moisten the sand and make a hole with the index finger in the center. Wash earth from the roots of the plantlet to be used and set it into the hole. Pack the sand gently around the stem.

The following solution is a general-pur-

pose one and will give average results with tomatoes, squash, cucumbers, and most flowers: 3 teaspoons epsom salts; 1 teaspoon muriate of potash; 2 teaspoons superphosphate; 1 teaspoon sodium nitrate. Use salts of the commercial grade sold for fertilizers (not chemically pure). Dissolve each thoroughly in a separate pint of water and siphon off the clear solution. Pour the clear solution from all four into a 5-gal. bottle

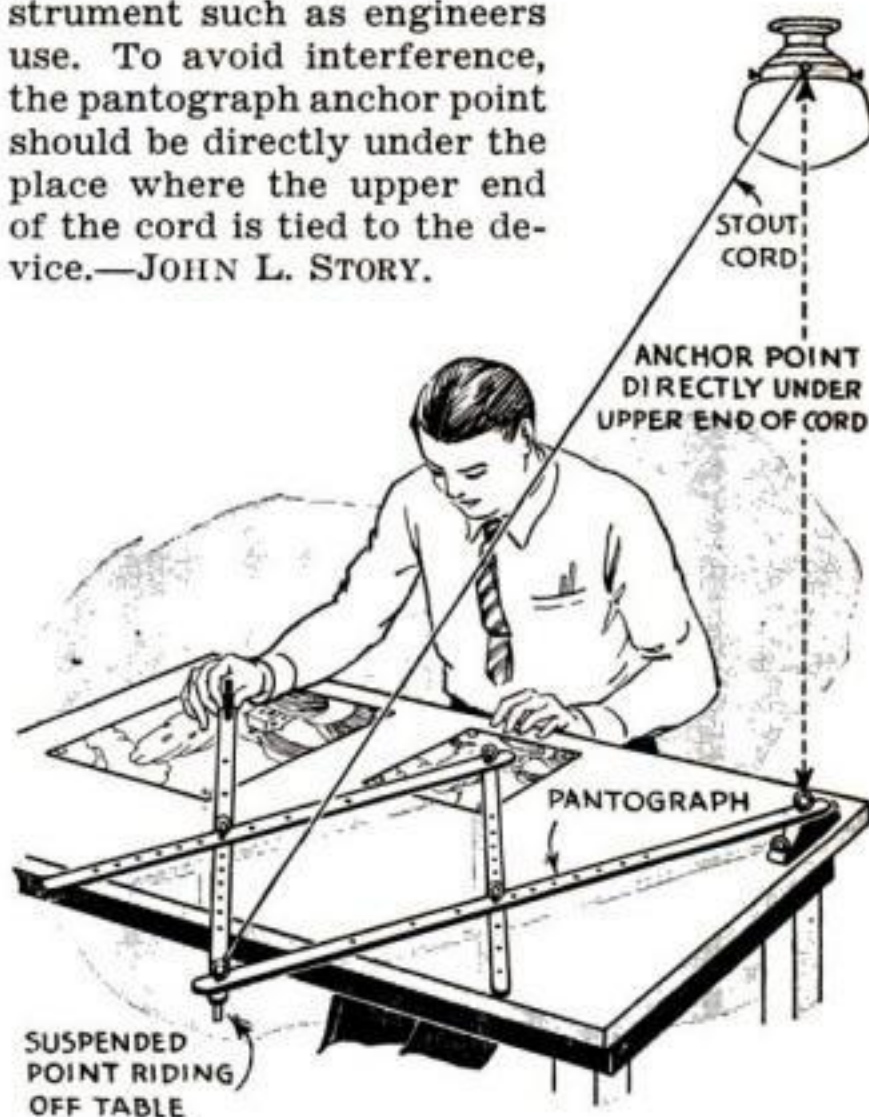
Now measure out $\frac{1}{4}$ teaspoon manganese sulphate, $\frac{1}{4}$ teaspoon zinc sulphate, $\frac{1}{2}$ teaspoon iron sulphate, and $\frac{1}{4}$ teaspoon boric-acid powder. Dissolve all four in a pint of water. Add 1 teaspoon of this solution to the first solution and fill up the bottle with enough water to make 5-gal. Keep this bottle corked.

Fill the 1-gal. bottle from the solution in the 5-gal. container, put in a cork lightly, invert, and set in the bottle rest, pulling out the cork just before the neck reaches the bowl. One gallon will last about four weeks. When it has been used up, wash out with fresh water both the gallon bottle and the bowl, and refill the bottle. A cloth cover should be tied around the neck of the 1-gal. bottle to keep insects and dirt out of the bowl. About every ten days, 1 gal. of fresh water should be passed through the crock to wash out any accumulation of salts, or the plant will not thrive. If the sand gets too dry, the plant may be sprinkled with water without any detrimental effects.



Using a Big Pantograph on a Small Table

BY SUSPENDING a large wooden pantograph as shown, it will work on an ordinary table or large drawing board very much like a costly suspended instrument such as engineers use. To avoid interference, the pantograph anchor point should be directly under the place where the upper end of the cord is tied to the device.—JOHN L. STORY.

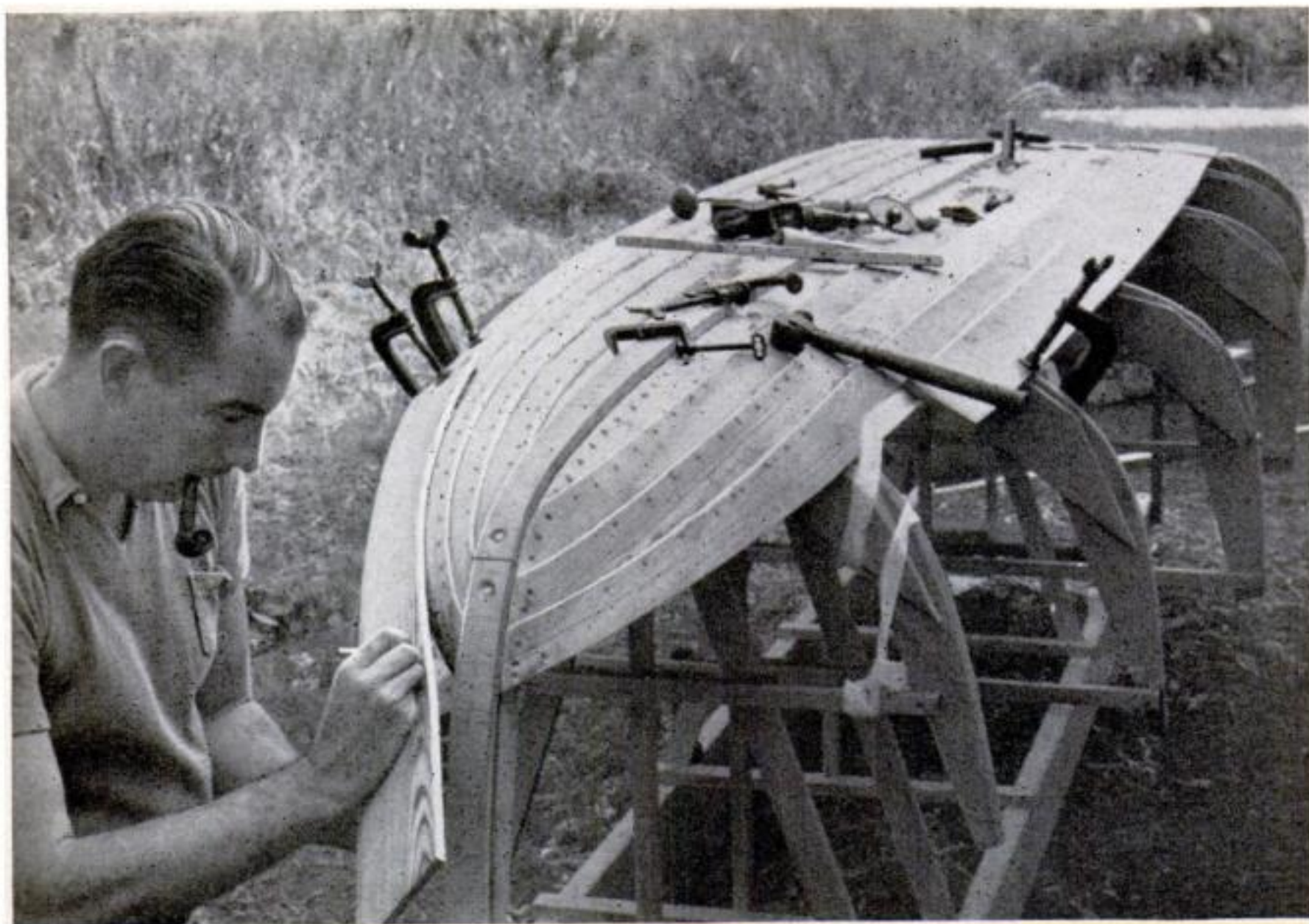


A ceiling fixture or any convenient overhead point may be used for suspending the pantograph

Ignition Cord Improves Thin Six-Inch Scale

THIN 6" steel machinists' scales, so often used for small layout work in the shop, are hard to pick up, and when the work is coated with whiting, the finger tips invariably cause smudges that obscure the markings and make it difficult to follow the layout. This difficulty disappears if a short length of rubber insulation is split and carefully removed from a piece of auto ignition cord, then slipped on the scale as shown. To pick up the scale, simply roll back on the rubber, and the front edge rises so it can be gripped. The rubber may be cemented to the rule if it tends to slip.—F. B.





Some of the planks take such a shape that it is best to make them in two pieces to avoid excessive waste

PART TWO

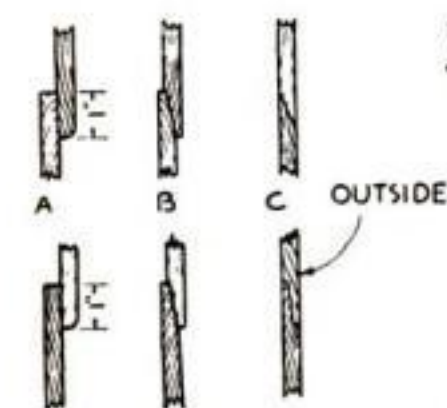
By Bruce and Willard Crandall

Planking

OUR new 13½' round-bottom utility runabout, or family boat, is now ready to be planked. The lap-streak method of planking is recommended and will therefore be described in detail, but other methods will also be covered briefly in the next installment for those who prefer calked-seam, compressed-seam, or canvas-covered construction.

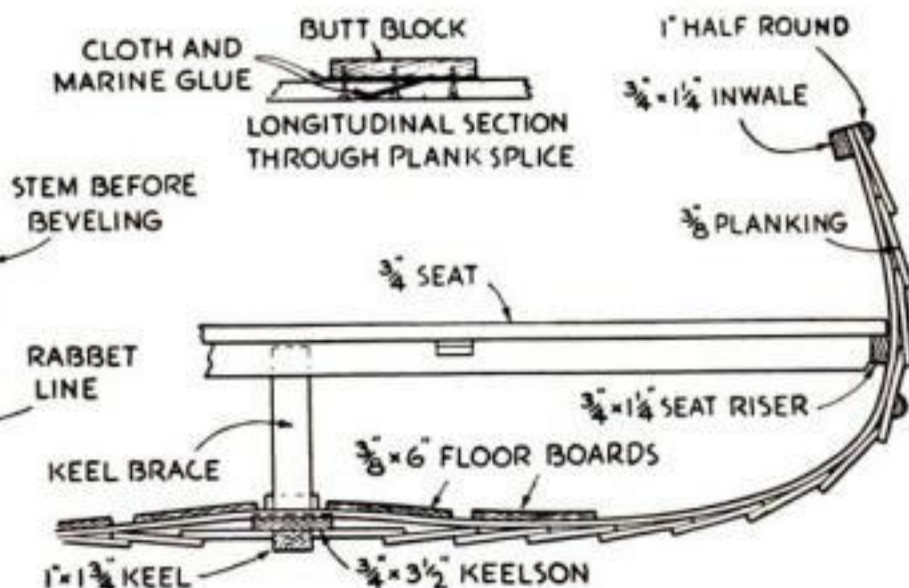
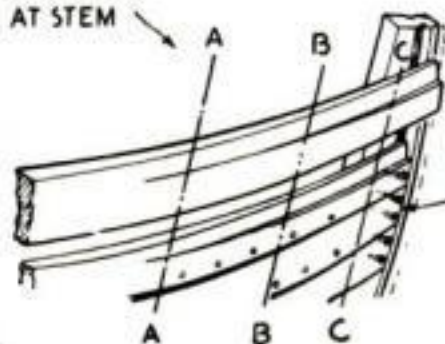
A steam box will be needed for bending the ribs, and if this is built now it will come

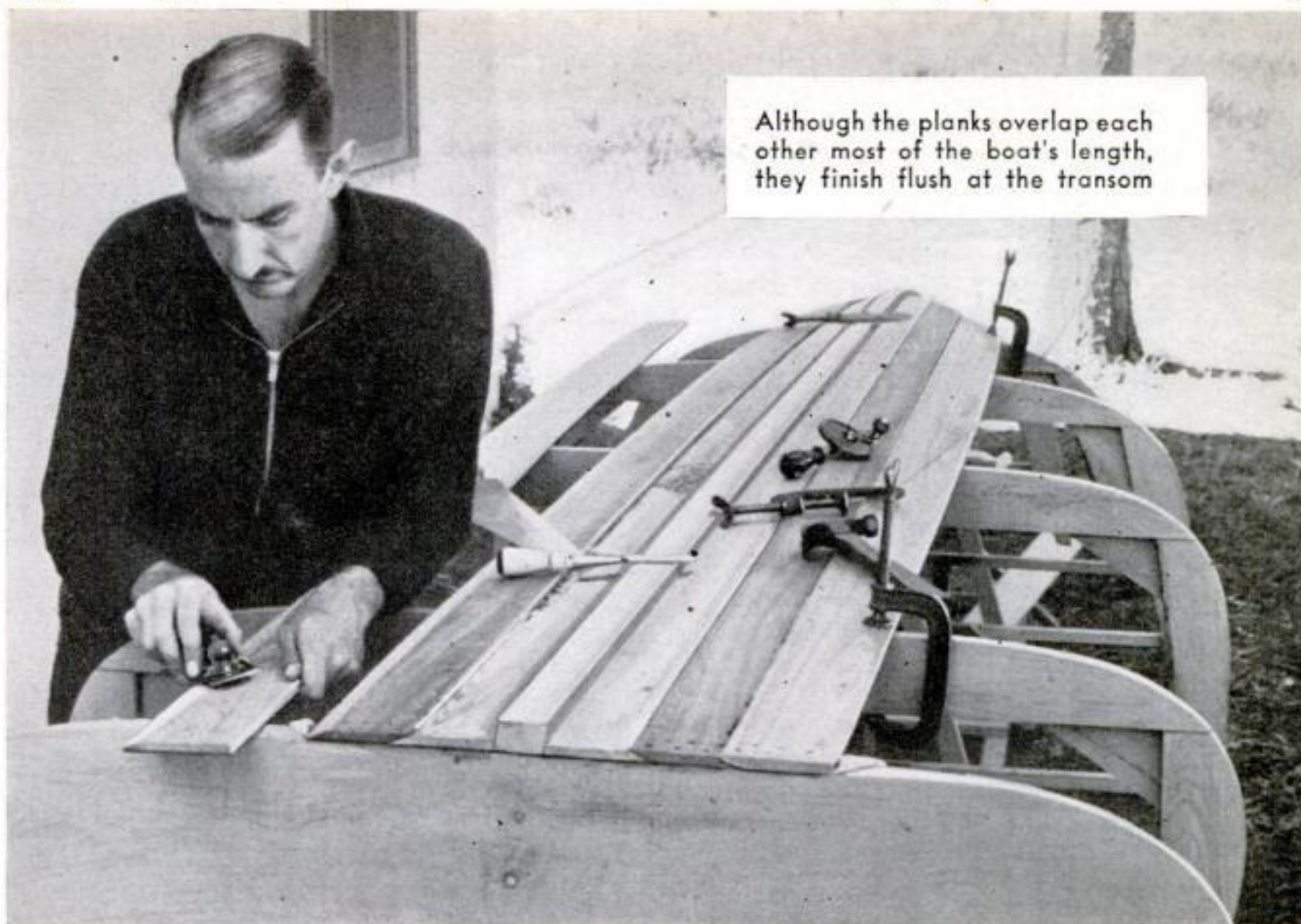
in handy for steaming the forward ends of some of the planks. A simple steam box can be made by using an 8½' length of rectangular metal drainpipe with a short piece of ½" pipe soldered to it in the center, which is in turn connected with a short rubber hose to an ordinary teakettle. Plug one end with a block of wood, and close off the



CROSS SECTIONS THROUGH LAPS SHOWING TWO METHODS OF FINISHING PLANKS AT BOW AND STERN

HOW PLANKS ARE FITTED AT STEM





Although the planks overlap each other most of the boat's length, they finish flush at the transom

Our New Family Boat

other end with a piece of gunny sack while the planks or ribs are being steamed.

In order to make a good-looking job, all the planks must be the same width at any one mold. There will be at least twelve planks on each side. Using a pair of dividers, mark the surface of each mold and the transom from the keel to sheer into twelve equal parts. This will give a guide for placing the planking edges. The stem should also be marked so that each plank will be of equal width at the bow.

Start the planking with the planks next to the keel—the gar-board planks. They are fitted to the keel and stem. This can most easily be done by clamping them in place and marking along the edge to be fitted with an ordinary pencil compass. Once they are



fitted to the keel and clamped in position, make a mark on the underside at each station, including the stem and transom, corresponding to the marks on the molds; then remove the plank and connect up these marks into a true curve with the aid of a long batten and saw away the extra portion.

After each plank is in place, the next plank is fitted by clamping it in position and simply marking on the inner surface. Next, mark on the previous plank with a compass the 1" allowed for the lap, and clamp the new plank in its final position in such a way that it comes exactly to the mark at all points. The other edge of the plank is then determined from the marks on the molds as previously described.

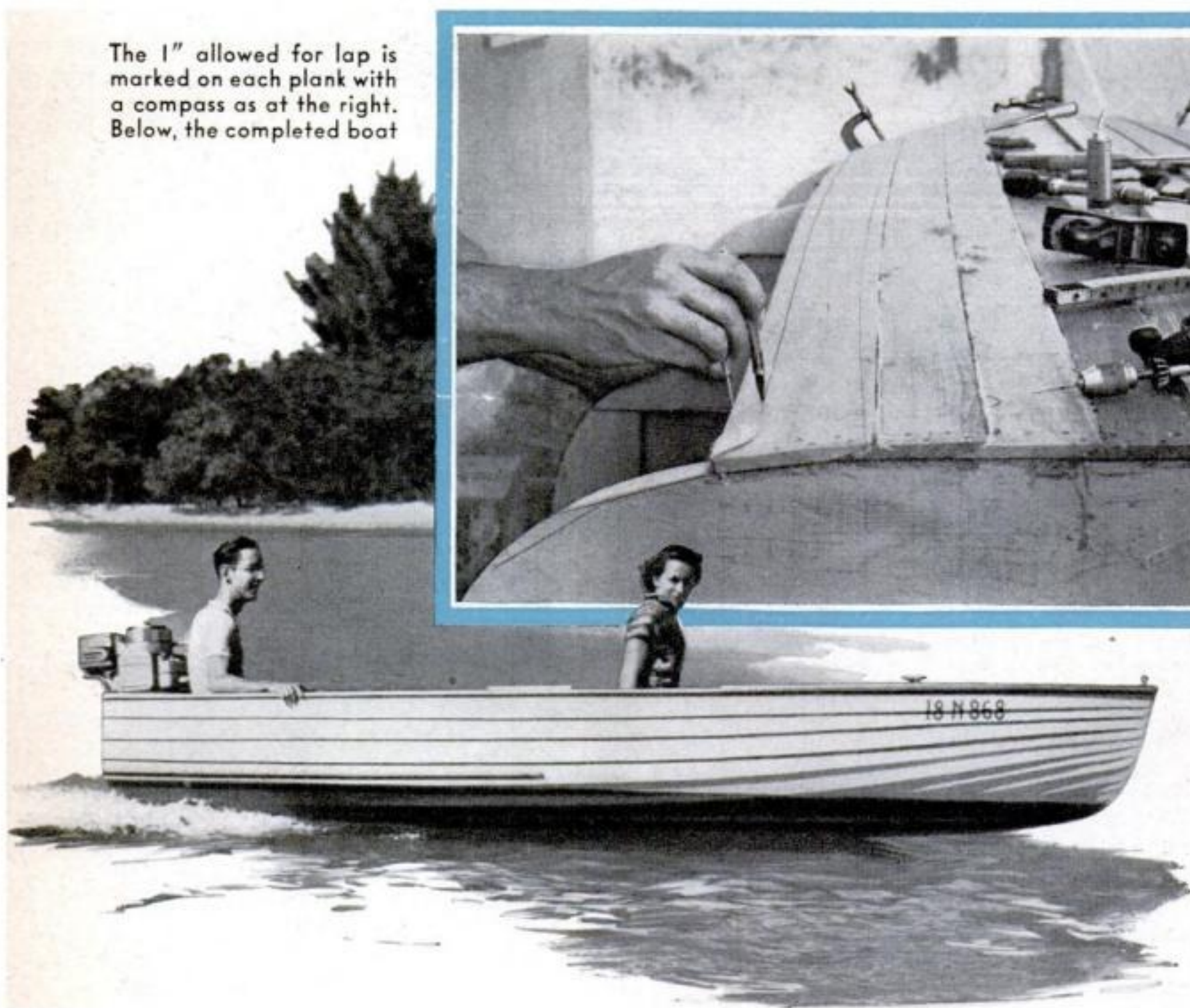
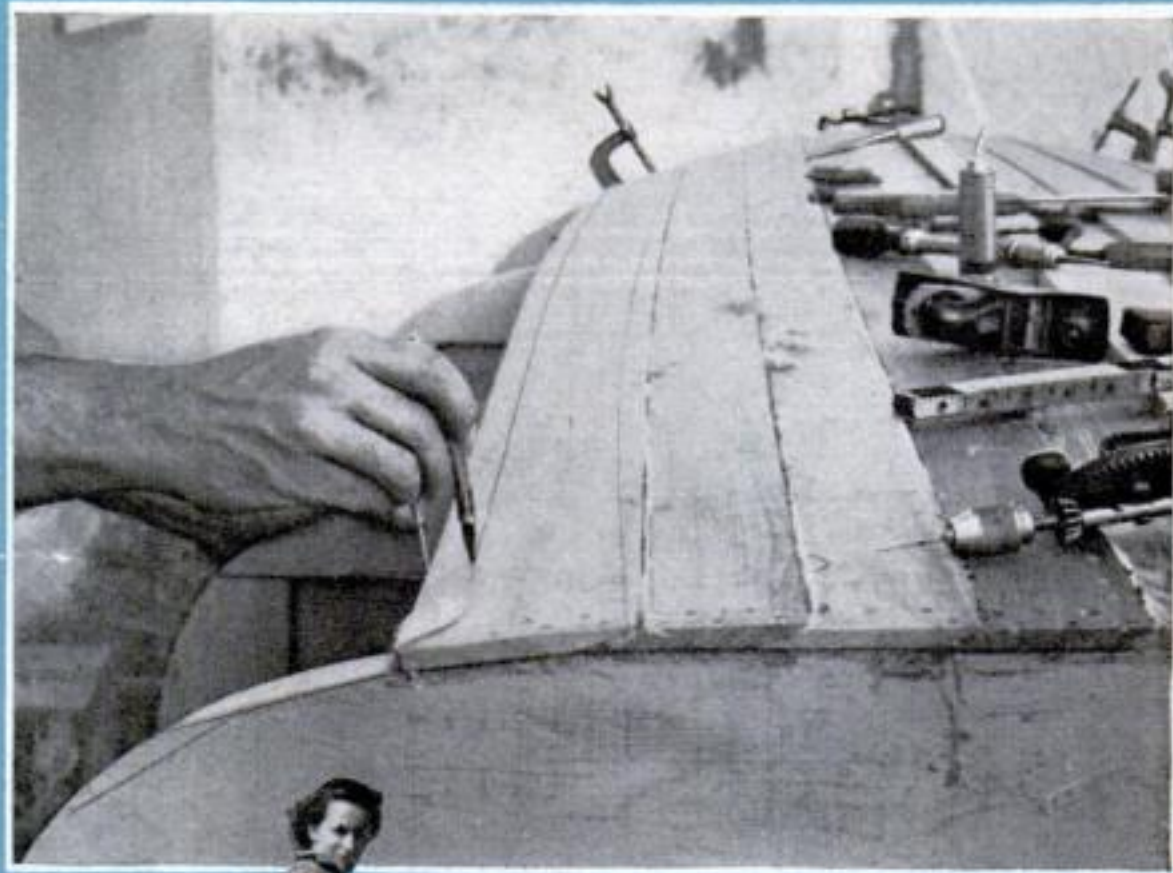
Before each plank is fastened in position, it is necessary that the surface of the previous plank, over which it will lap, be planed to the proper bevel. Though the plank edges overlap each other most of the length of the boat, at the stem and transom they finish off flush. This is done by increasing the bevel gradually from a point about 24" from the transom and stem and cutting a similar bevel on the next plank so that the two will fit together snugly and elimi-

nate the extra thickness of the lap at the bow and stern. This is best understood by reference to the drawings. When each plank is cut to shape, use it as a pattern for the similar plank on the other side of the boat. A great deal of fitting is then saved.

As a preliminary but essential step in securing each plank, apply marine glue to the surfaces which are to be made water-tight, such as the stem, keelson, transom, and lap-over space on the previous plank; then lay a strip of cotton flannelette over the joint and coat the cloth also. When the planks are fastened down, the glue will squeeze throughout the joint and make it perfectly water-tight.

The planks should be fastened to the stem with 1 1/4" No. 8 screws, and larger where necessary, spaced about 1" apart. Use a double row of 1" No. 7 screws into the transom and transom frame, spaced about 1" apart. The garboard plank is screwed to the keelson with 1" No. 7 screws spaced about 2" apart, while the planks are all fastened together at the laps with 1 1/4" galvanized nails or with copper rivets, also spaced 2" apart. If nails are used, they should be well clinched by first knocking

The 1" allowed for lap is marked on each plank with a compass as at the right. Below, the completed boat



Better than 25 miles an hour can be obtained in this skiff with a 16-h.p. outboard motor

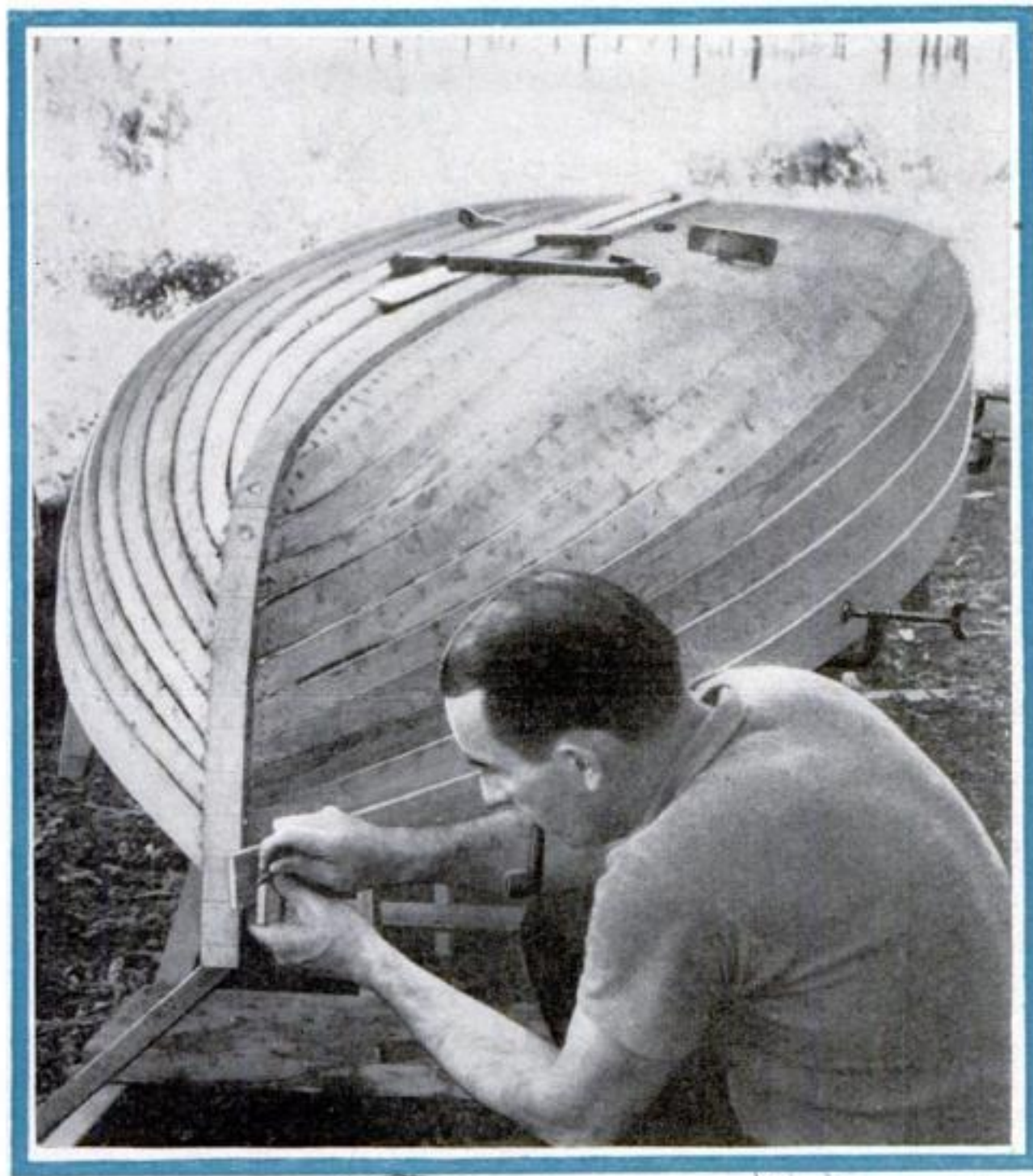
them over from the inside and then hitting the head with a hammer while a clinching iron is held against the undersurface.

Most of the planks can be made from 6" widths, but 8" will have to be used in certain cases. Some of the planks take such a shape that it will be best to make them in

two shorter pieces to avoid excessive waste and cross grain. Where the planks are spliced, they should be screwed to butt blocks, which are first coated with marine glue. No two splices should be close to each other.

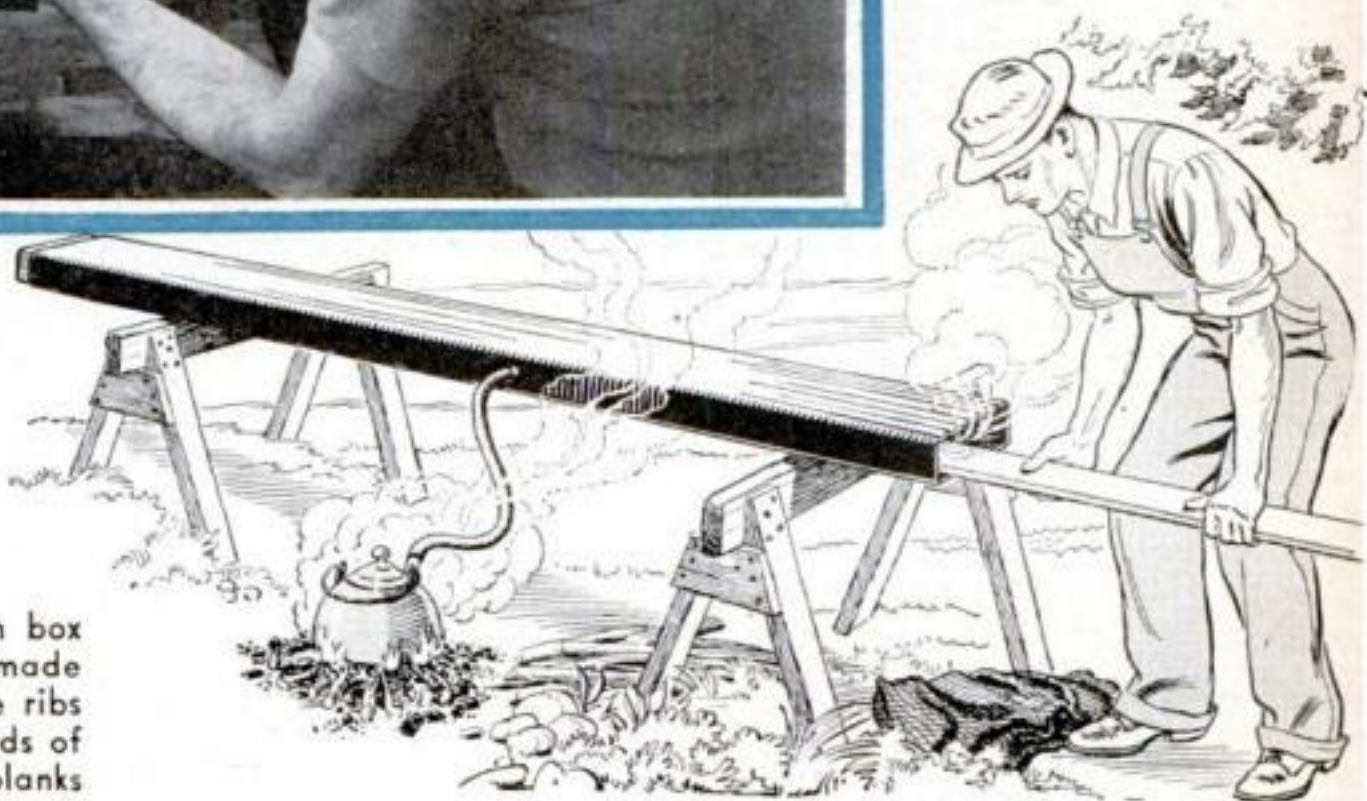
There is a great deal of waste to the planking, as on any round-bottom boat, and though 6" (5½" net) boards are used in most cases, the planks after being fitted and cut to shape are not more than 4¼" wide at any point. In lapstreak construction no attempt should be made to bend the planks around the curve of the transom (each plank is straight in cross section); instead, the transom should be cut straight where each plank is fastened to the edge.

After the planking is completed, turn the boat right side up, removing it from the keel form but leaving the molds in place, if desired. The inside of the hull should be given a priming coat at this time. Then notch the keelson about ¼" deep at each point at which a rib will be placed, and mark the location of each rib on the inside of the top planks. The ribs need not be spaced closer than 6" because a lapstreak boat has considerable strength without any ribs, although it must have them, of course. (TO BE CONTINUED)



A snug, flush fit at the stem is obtained by gradually increasing the bevel of the planking from a point about 24" away

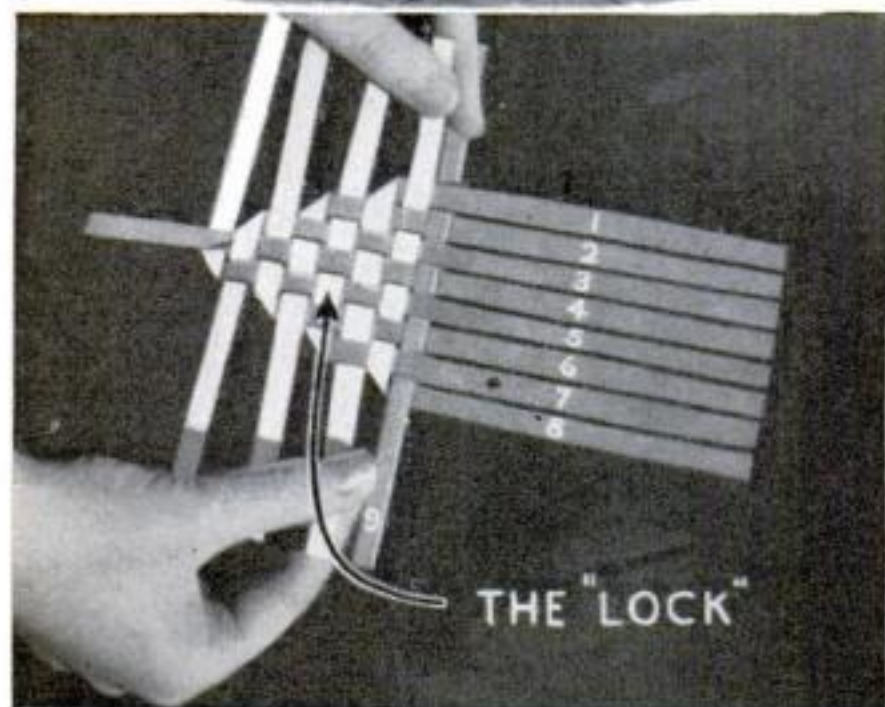
A simple steam box can easily be made for bending the ribs and forward ends of some of the planks



MINIATURE

Hawaiian Basket

HOLDS PIPE-CLEANER PUPS

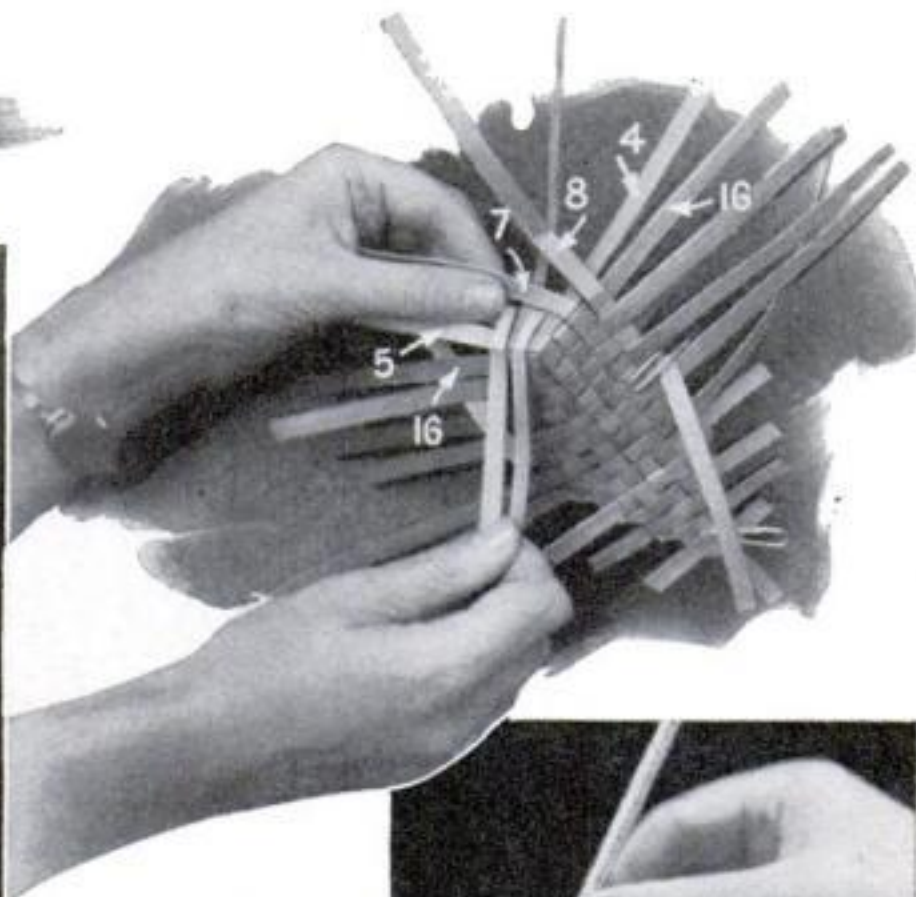


PPIPE-CLEANER pups peering over the edge of tiny Hawaiian baskets make attractive favors for a party table. The dogs themselves are made in the usual way, as shown at the right. For each basket, cut sixteen strips of cellulose wrapping material 1" by 8", fold lengthwise down the center, then open and fold each edge in to the center crease, moisten the inner edges and press together, making each strip four-ply.

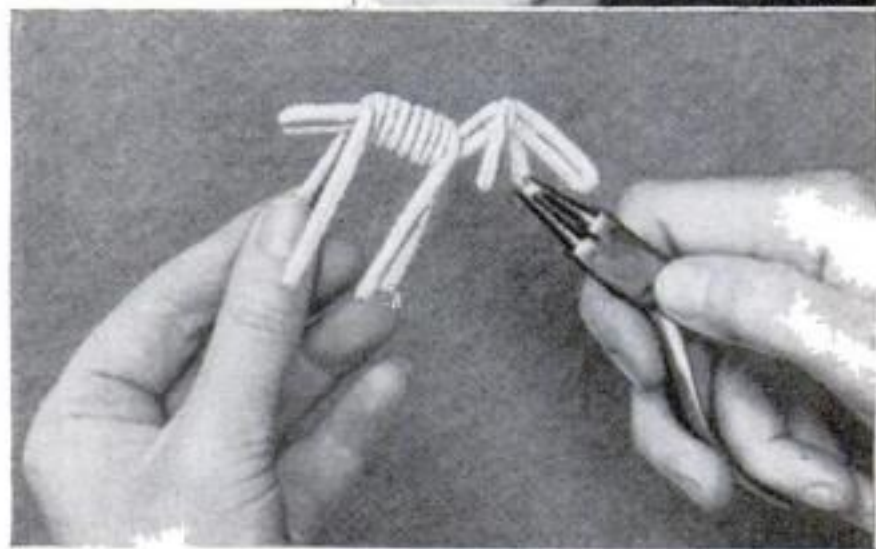
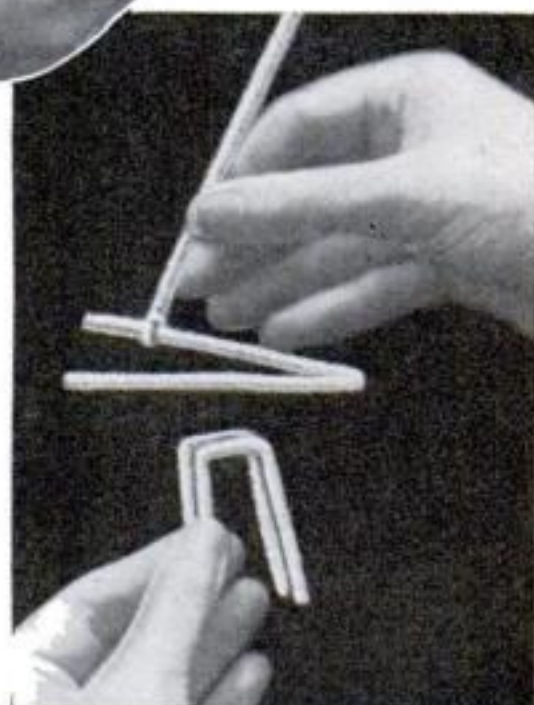
Lay eight strips parallel and weave strip 9 under and over, about 1" below the center of the strips. Be sure that strip 1 (left) goes over strip 9. Next make the "lock" shown above to hold the strips in place. It is unraveled later. Now weave in strip 10 by folding down and back the strips that are under strip 9, laying strip 10 on, and bringing the "down" strips back up and the "up" strips down. Weave in strips 11 to 16.

To make the first corner of the basket, lift the work off the table, fold the center of the end of the mat in a 90-deg. angle (fold away from the body between weavers 4 and 5), bring strip 5 over to the left and weave it in. Thus the end of strip 5 lies just above strip 16. Similarly weave in the ends of strips 6, 7, and 8 as shown. Put in a paper clip at the edge. Repeat on the other three sides of the mat, taking out the lock before making the fourth corner.

Pick out one of the strips pointing to the



Left, beginning the basket by making the lock. Reverse sides of strips are shown a different color for clearness. Above, weaving the first corner. Right and below, how a dog is made



right (basket held in front, bottom down), unravel it back to the depth where you want the edge, fold it back and over at 90 deg. and thread it under and over the next strip for two or three spaces, then cut off the end. Continue around the basket. Trim off, inside, all the strips that pointed up and to the left.—WINIFRED G. HAMMOND.



NEW SHOP IDEAS

Electric Finder for Hidden Pipes and Conduits

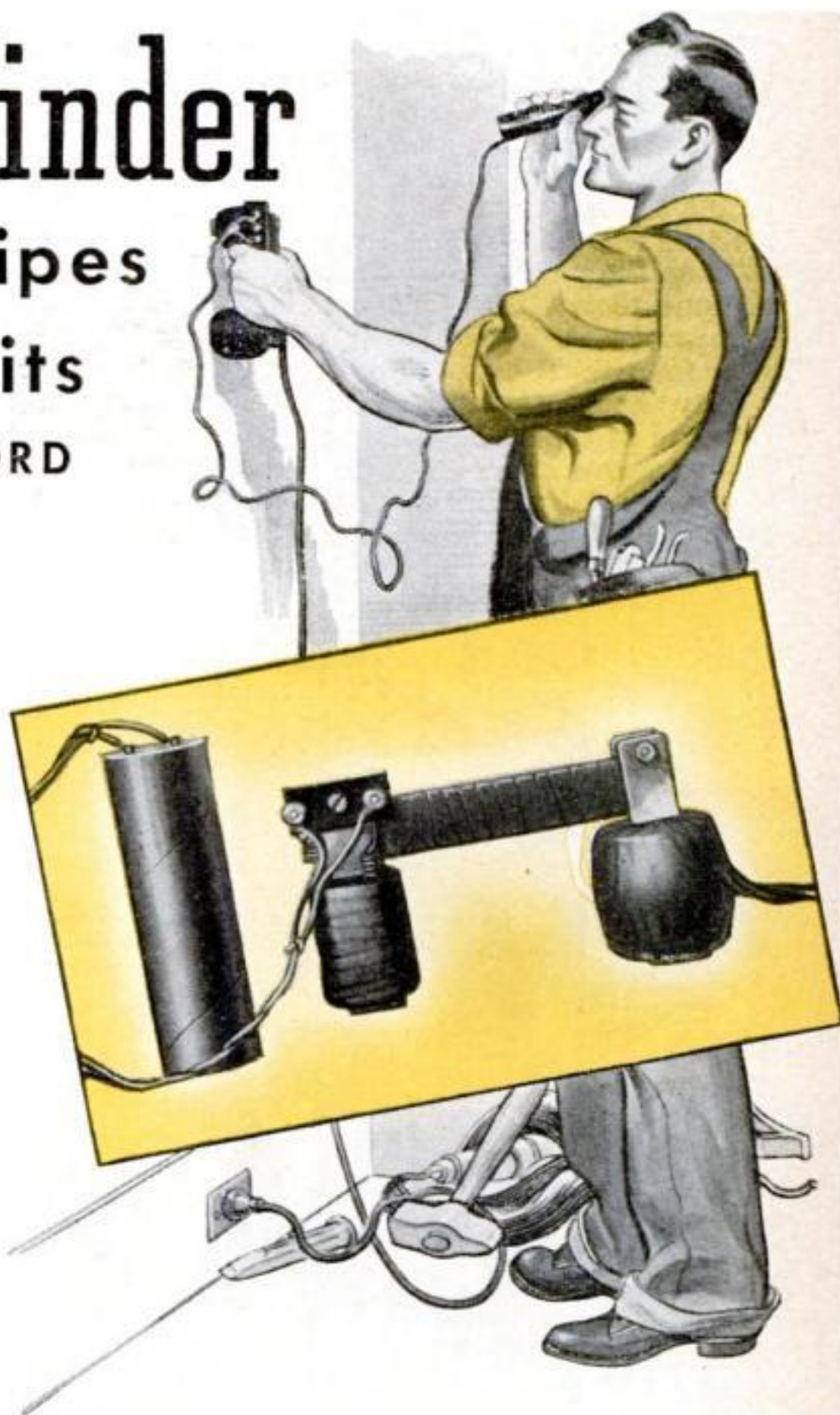
BY KENDALL FORD

BUILDING mechanics, plumbers, and electricians no longer need remove excessive amounts of material in order to locate iron or steel pipes in the walls or floors of buildings. This easily made indicator reveals accurately the location of water and gas pipes, electric conduits, and even steel reinforcing bars in concrete. It was designed to help an electrical contractor who was rewiring a reinforced-concrete building and losing much time because his workmen so often struck steel obstructions when they attempted to drill through the walls.

The indicator described is accurate to a depth of approximately 3", but readings for greater depth can be attained by lengthening the connecting core section.

Since the finder depends upon a varying magnetic circuit for its operation, the metal being sought must be either iron or steel. Brass, copper, lead, or any other nonmagnetic material will not register. The indicator is not a treasure finder. The material in which or behind which the iron or steel is hidden must be nonmagnetic such as brick, concrete, plaster, wood, earth, or any nonmagnetic metal.

The device consists essentially of a three-sided core upon which has been placed a primary and a secondary winding. When the primary winding is connected to 110 volts A.C. and the secondary to a flash-light bulb in a cardboard tube, the lamp will light



As the indicator approaches hidden metal, a bulb in the tube glows more and more brightly until directly over it

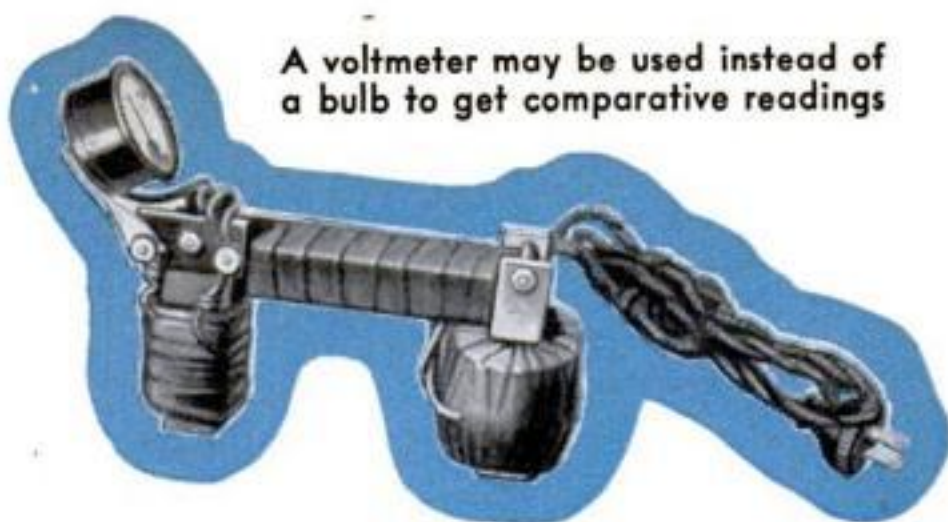
to full brilliancy as soon as the indicator is brought over a metal pipe or rod. Any deviation from the position directly over the metal will be indicated by a dimming of the bulb.

To make the core, obtain enough transformer steel to form a pile of laminations $1\frac{1}{8}$ " high of each of the sizes shown at Fig. 1. If transformer steel cannot be obtained,

26- or 28-gauge stovepipe iron may be substituted.

Make a core-stacking form for the longest section of the core by driving five or six finishing nails into a board, with the distance between the end nails $7\frac{1}{8}$ ". Place two pieces of friction tape on the board to hold the core together temporarily, and begin to stack the long core section. Place the first lamination so that the end touches one of the end nails. Set the second one on this so that one end touches the other end nail—in other words, so that the second piece projects $1\frac{1}{8}$ " beyond the first. Continue alternating in this way until all the long laminations have been stacked.

Wrap the pieces of tape around the laminations, remove the whole section, and place it in a vise with about $1\frac{7}{8}$ " extending beyond the jaws. Wrap a piece of friction tape tightly around the end of the core, reverse the core in the vise, and tape the opposite end. Remove the core from the vise and wrap the solid portion with a layer of friction tape. Alternately insert a 4" long and a



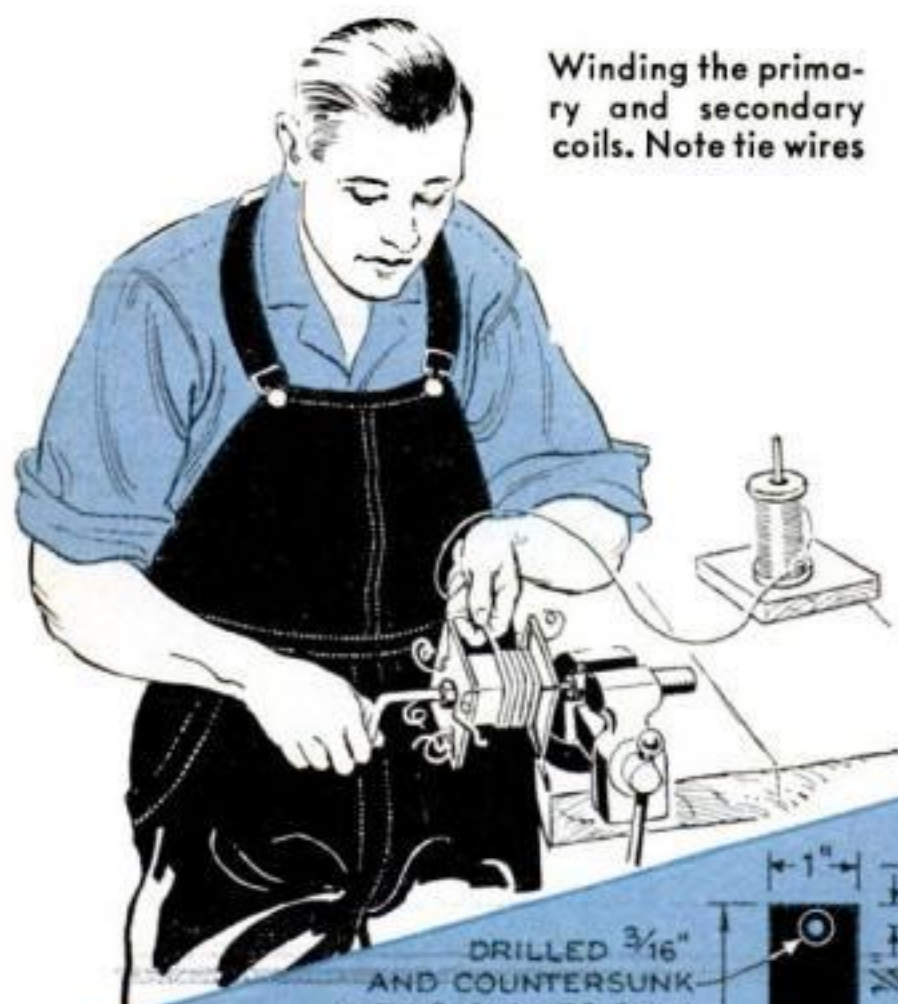
A voltmeter may be used instead of a bulb to get comparative readings

$2\frac{7}{8}$ " long lamination in an end of the taped section until that end is filled. Wrap with friction tape and follow the same operation with the opposite end.

Bend and drill four core clamps as shown in Fig. 2. Then drill a $\frac{3}{16}$ " hole to match through the lower part of the short core sections as shown in Fig. 3. In drilling through the core sections, they must be securely clamped down, otherwise the laminations will tend to spread apart.

Make a winding form as in Fig. 4. This consists of a wood block center and two plywood sides, held together with a threaded winding crank. The center block and sides are slotted to take tie wires, which are inserted before the coils are wound. The tie wires may be 8" lengths of No. 20 magnet wire.

Wrap two layers of thin cardboard around the center of the winding form and then wind on 1,200 turns of No. 20 double cotton-covered wire. Twist the ends of the tie wires around the coil and remove the coil from the form. Connect a piece of flexible lamp cord



Winding the primary and secondary coils. Note tie wires

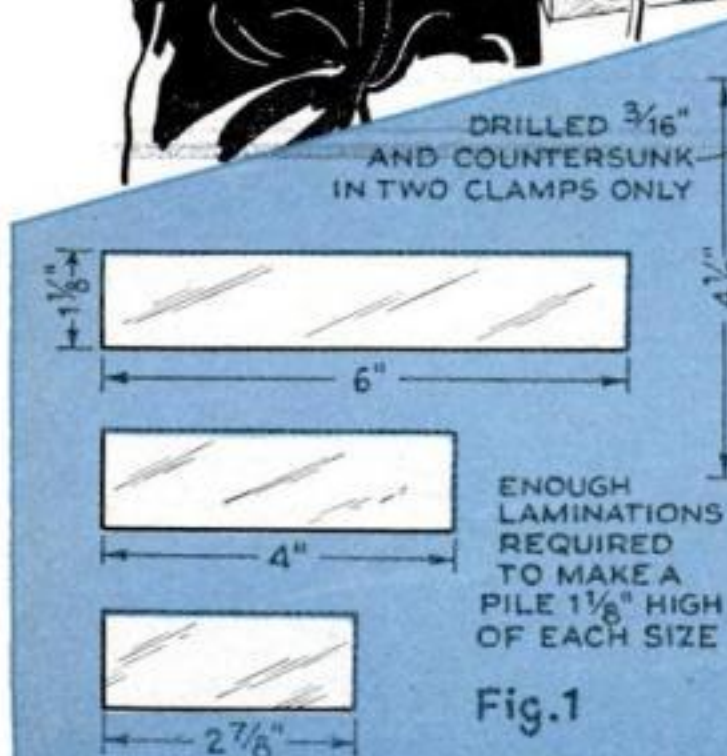


Fig. 1

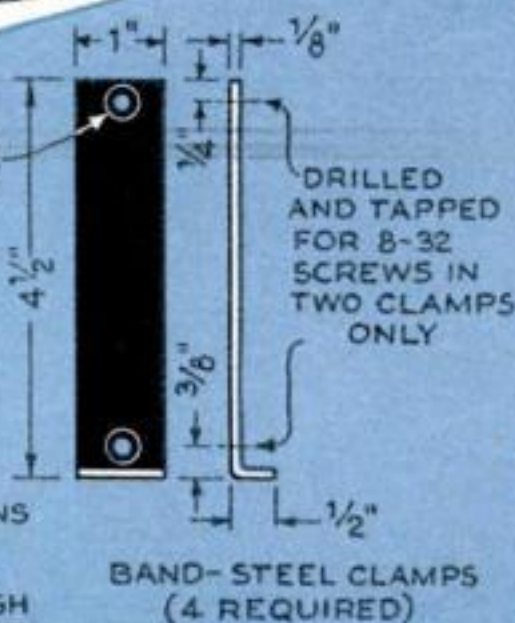


Fig. 2

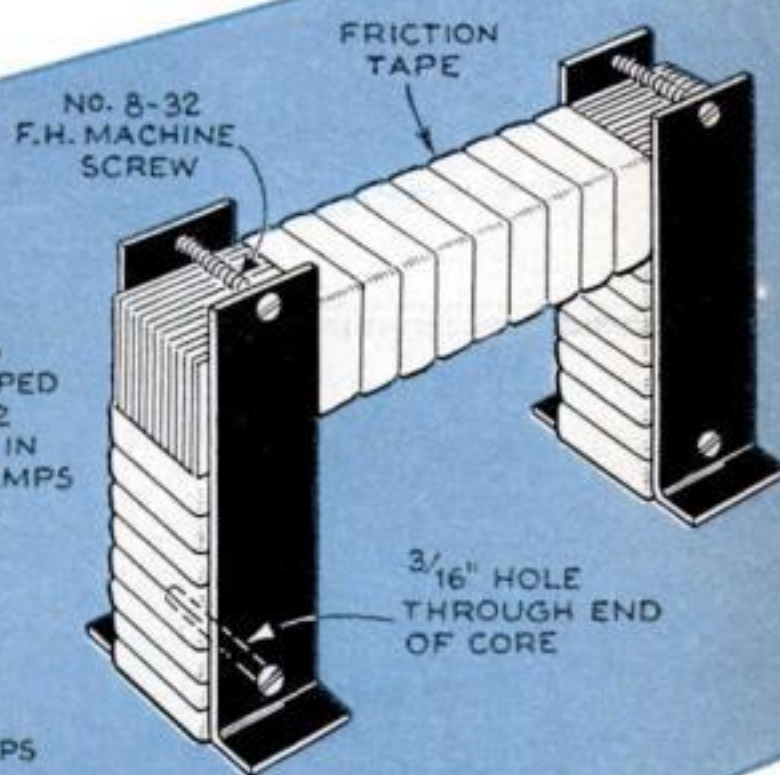


Fig. 3

to the ends of the coil, tape the connections with friction tape, then wrap the coil with linen tape.

Wind the secondary coil in a similar manner with 135 turns of the same kind of wire, tape with linen tape, and bring the leads out to a fiber or composition terminal strip as in Fig. 5. Approximately 1 lb. of wire will be required for the primary coil, and $\frac{1}{4}$ lb. for the secondary coil.

In assembling, the coils are set on the cores, then the core clamps are placed through the coils. With the clamps in place, the coils are raised until the screws can be set through the core; then the coils are lowered and the upper ends of the clamps screwed together. If the coils are loose on the core, they may be wedged with pieces of wood or heavy cardboard.

The indicating part of the device is a 6- to 8-volt miniature-base bulb secured in the end of a cardboard tube, as shown in Fig. 6. Where comparative readings are desired, an 0- to 10-volt A.C. voltmeter may be substituted for the arrangement shown with excellent results.

Since the depth at which the

apparatus will register is determined by the distance between the short core legs, the accurate range of a detector of the dimensions given will be approximately 3" away from the core ends, although it is possible to detect a change in the brilliancy of the bulb 5" or 6" away. To locate metals at a greater depth, it will only be necessary to make the long section of the core twice as long as the depth at which an indication is desired. For example, if an indication to a depth of 5" is desired, the core section should be 10" long.

To a certain extent, however, the depth at which the indicator will function depends upon the size of the metal being located and will vary accordingly.

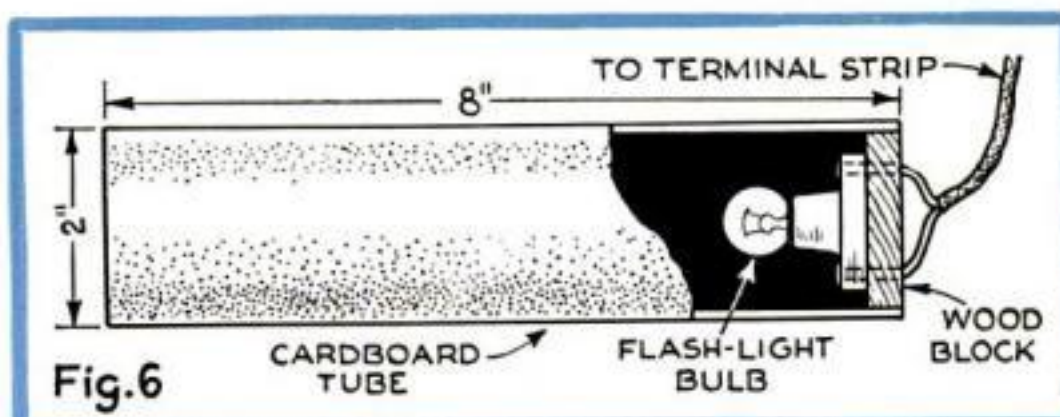


Fig. 6

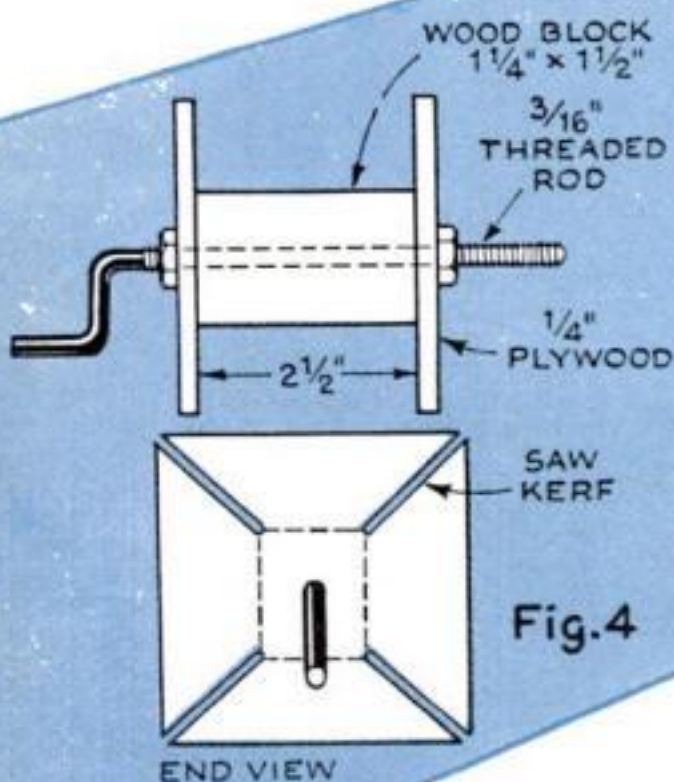


Fig. 4

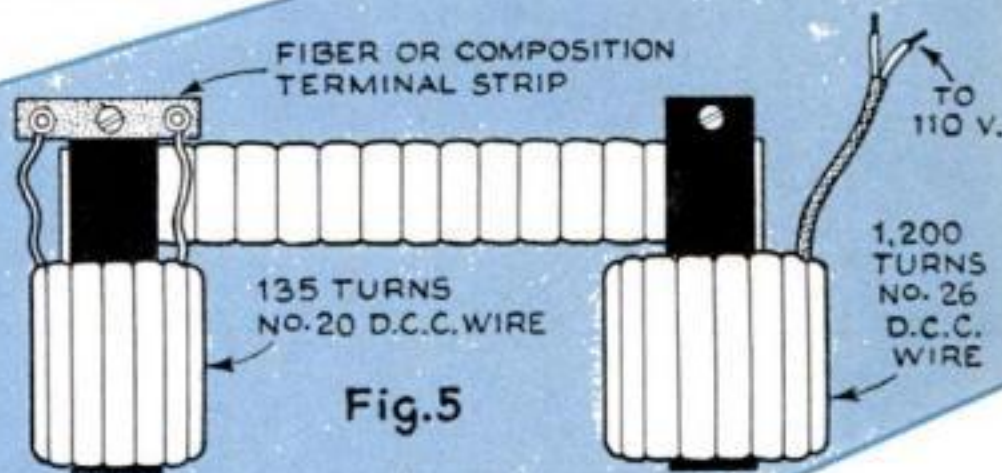
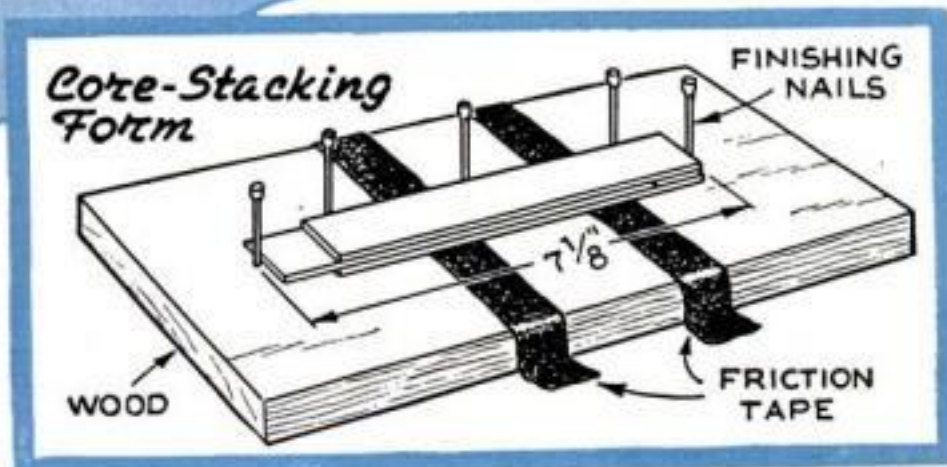


Fig. 5

The laminations are stacked so that alternate pieces touch alternate end nails on the form as below



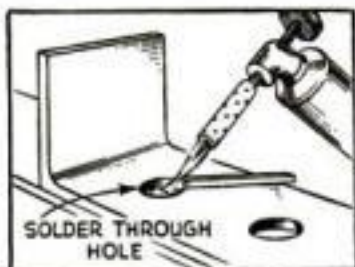


Tin-Can Scraper Cleans Soot from Stovepipes

AN EXCELLENT scraper for cleaning soot out of stovepipes can be made by screwing a wide-mouthed tin can onto the end of an old chair leg or other stick as shown. The mouth of the can can be squeezed as necessary to make a perfect fit against the inside of the pipe.—WARREN F. ROBINSON.

Spot-Soldering Sheet Metal

SWEAT-SOLDERING pieces of sheet metal together is often difficult because of their tendency to creep and get out of alignment. This can be overcome by drilling a series of holes through one piece and filling the holes with solder. Afterwards the excess solder is filed away.—S. J. GANCHER.



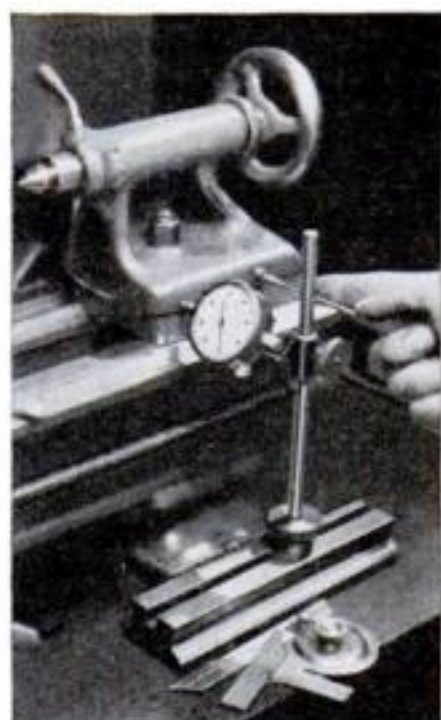
Long Wood Screw Cleans Grease from Gears

GEARS full of gummed dirt and grease can often be cleaned without dismantling the parts by using a long wood screw as shown at right. Cut off the head and set the shank in a file handle. The screw may be bent somewhat if necessary to get it at the teeth.



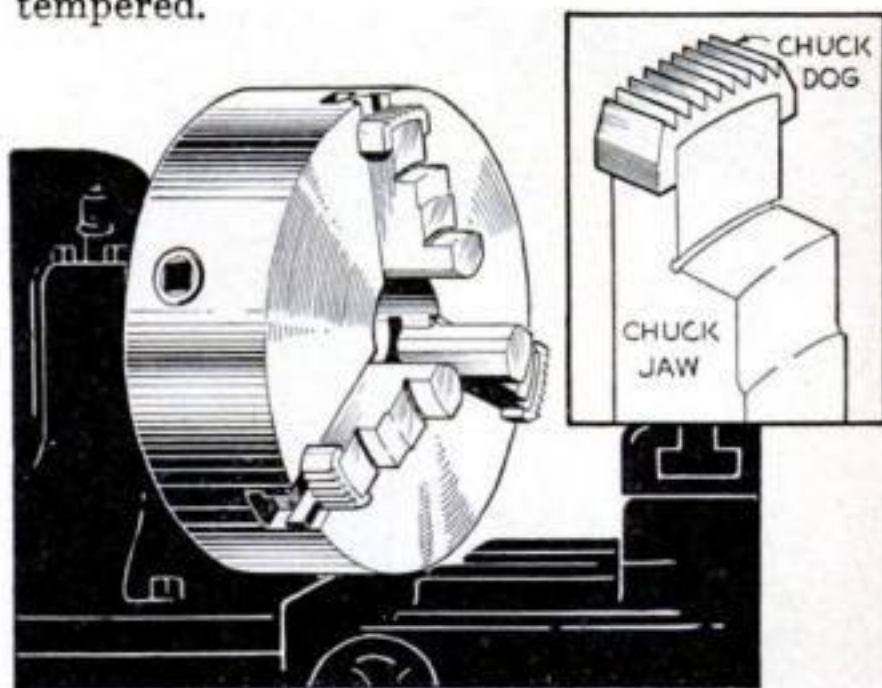
Setting Over a Tailstock for Taper Turning

IN TURNING tapers by the set-over tailstock method, the final adjustments can be made very accurately by placing a dial test indicator against the movable part of the tailstock. The dial needle will indicate the last few thousandths and also show which way the tailstock center is being moved.



Toothed Chuck Dogs Keep Thin Work from Slipping

FOR machining large, thin castings or tubing held in a three-jawed universal lathe chuck, the chuck dogs shown will prevent the work from slipping without the use of enough pressure to spring the job out of round. These dogs can be made of cold-rolled steel and case hardened, but will give much longer service if made of tool steel, hardened and spring tempered.



Teeth on the dogs should be cut about $1/16$ " apart

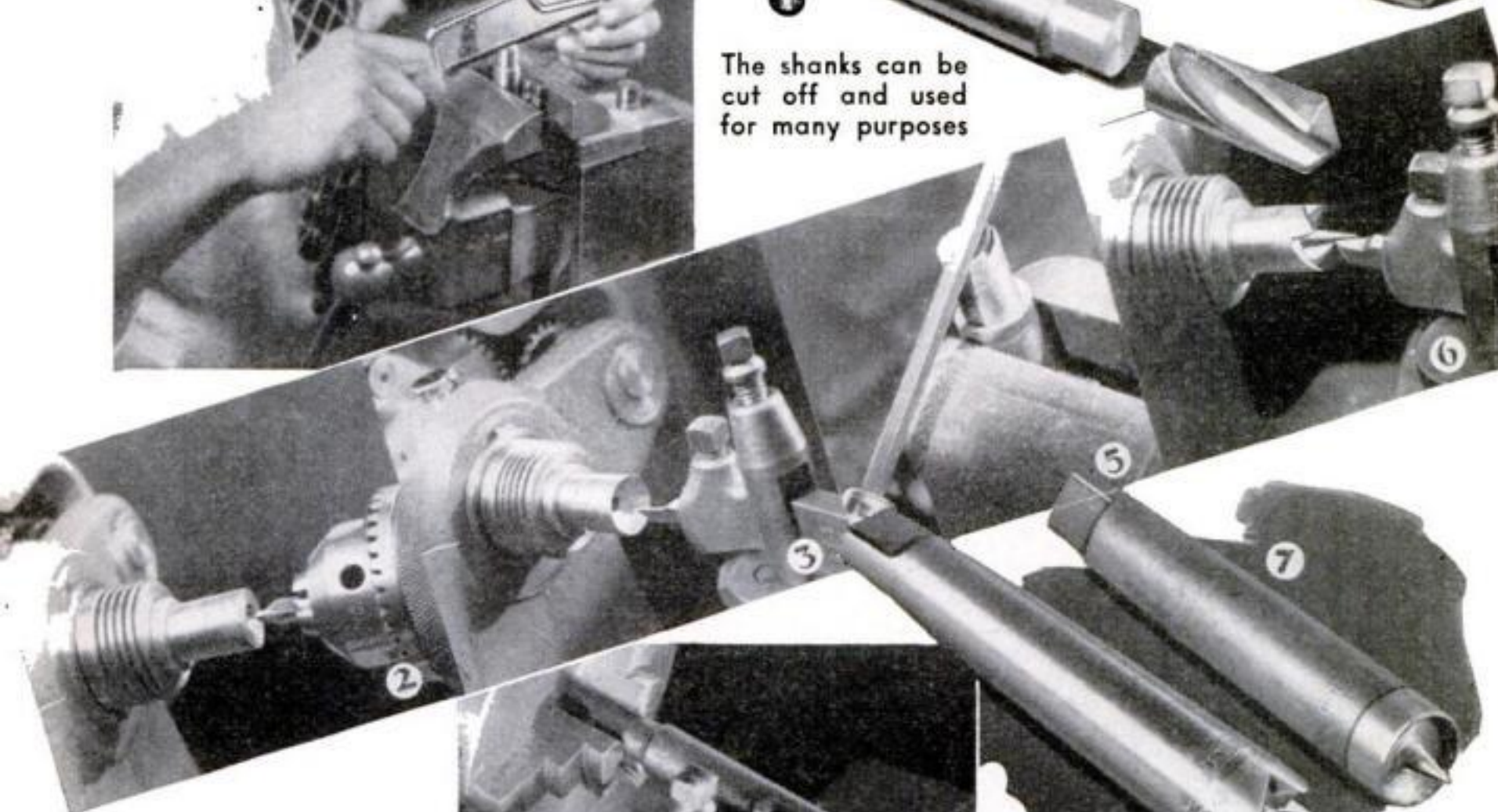
Wax Holds Pattern on Metal

THE sawing of small objects from metal with a jeweler's saw is made easier by fastening the paper pattern to the metal with beeswax. Warm the metal, rub on beeswax, and while the wax is still tacky, press the paper pattern in place. The wax also acts as a lubricant for the saw blade.—W. B.

Don't Throw Away OLD DRILLS



The shanks can be cut off and used for many purposes



MANY uses can be found for the tapered shanks of short or broken drills. They can be converted into arbors for drill chucks, drill pads, crotch centers, and the like, or made into wood-turning centers. Most drills are not hardened at the shank end and can be cut off with the parting tool (Fig. 1). While chucked as in Fig. 9, the tang is turned slightly smaller for clearance, and the taper is filed smooth and polished bright. The lathe chuck is then removed and the drill shank slipped directly into the headstock spindle sleeve so that the outboard end may be turned to fit a drill chuck, drill pad, or other lathe accessory (Fig. 10); or it can be made into a tailstock center for a wood lathe (Fig. 7) or a spur driving center (Fig. 8). The steps in making the latter are as follows:

Drill an accurately centered hole with a center drill (Fig. 2) and continue this hole to 1" in depth

with a $\frac{1}{4}$ " drill. With a sharp boring tool, cup the end (Fig. 3); then saw it in four equal parts (Fig. 4) and file the driving teeth (Fig. 5). A short length of $\frac{1}{4}$ " drill rod is driven into the hole and given a point with a lathe tool (Fig. 6).



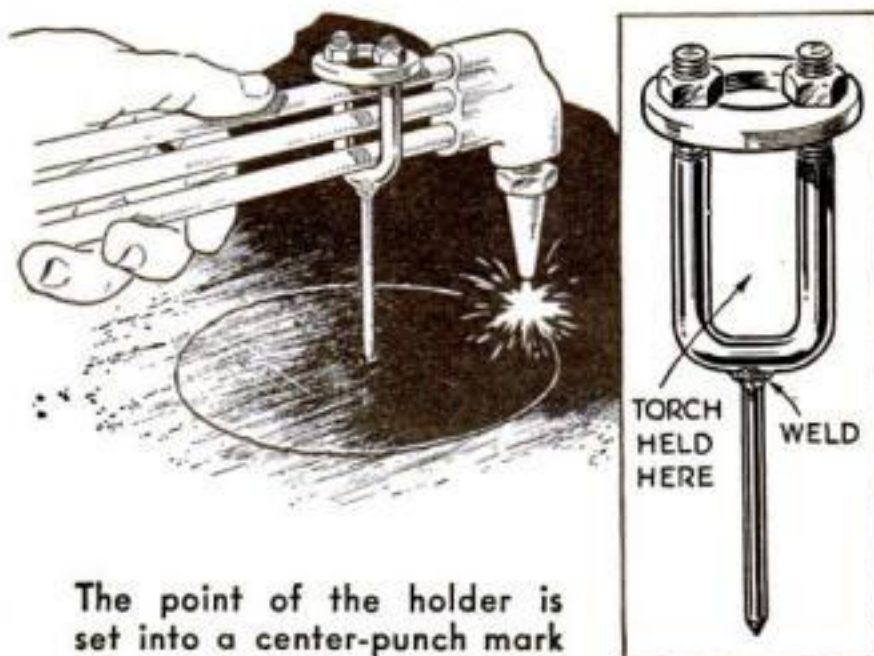
Strong Spring Prevents Tailstock from Binding

TO PREVENT a lathe tailstock clamp plate from binding when sliding the tailstock along the bed, put a strong coil spring between the clamp plate and the tailstock as shown below. The spring should be ground flat on the ends after heating the ends red hot with an acetylene torch and flattening with tongs or pliers. Take care, however, not to overheat the center of spring. If available, a standard stripper spring such as is used on dies is excellent. With the spring in place, a one-sixth turn of the wrench will lock or loosen the clamp completely. This eliminates the possibility of chattering.—HARVEY H. HURST.



Shop Data Kept in Frame for Ready Reference

THIS 16" by 20" frame is convenient for shop data. Use $\frac{3}{4}$ " by $1\frac{1}{4}$ " stock and rabbet $\frac{3}{8}$ " by $\frac{3}{8}$ " to hold a $14\frac{1}{4}$ " by $18\frac{1}{4}$ " piece of single-strength glass. This is kept in with $\frac{3}{16}$ " by $\frac{5}{16}$ " strips. Cut $\frac{1}{4}$ " plywood backing; fasten with door buttons.

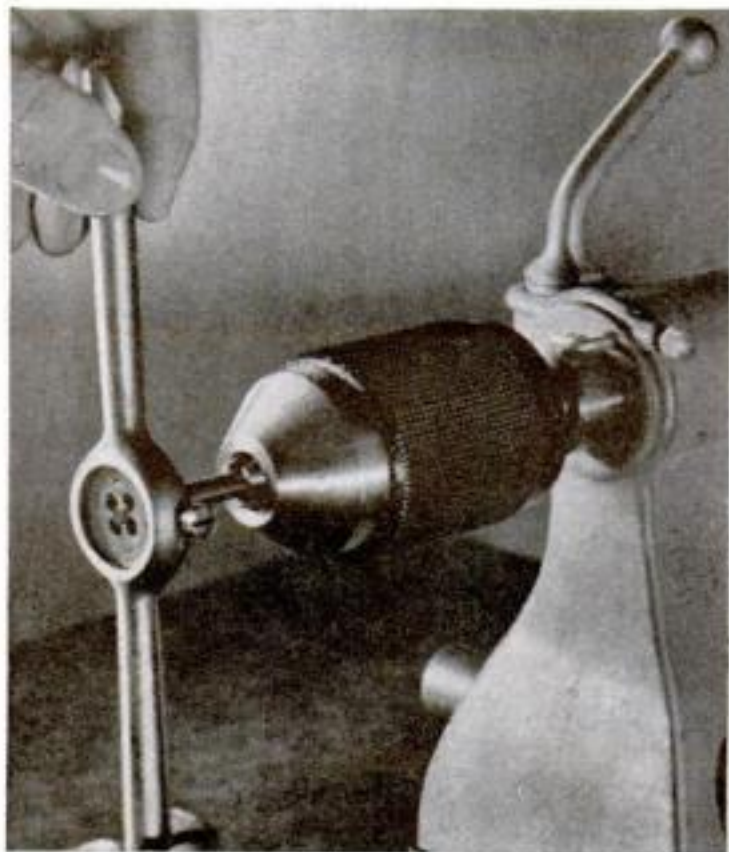


Simple Jig for Cutting Circles with a Torch

IN ORDER to cut perfect circles with an acetylene torch, a simple jig may be made from a cable clamp that will fit over the arm of the torch. Weld a small rod to the clamp, and grind this rod to a point. This jig is fastened on the torch at the proper point, and the rod is held in a center-punch mark on the work.—RALPH E. DASCHKE.

Drill Chuck Holds Rods While Being Threaded

SMALL rods and turned parts that are to be threaded are likely to be badly marred if an attempt is made to grip them in the vise. They may be held more securely and conveniently in a drill chuck placed in the tailstock of a lathe. There is then little or no danger of damaging the finished surfaces.—H. R. H.

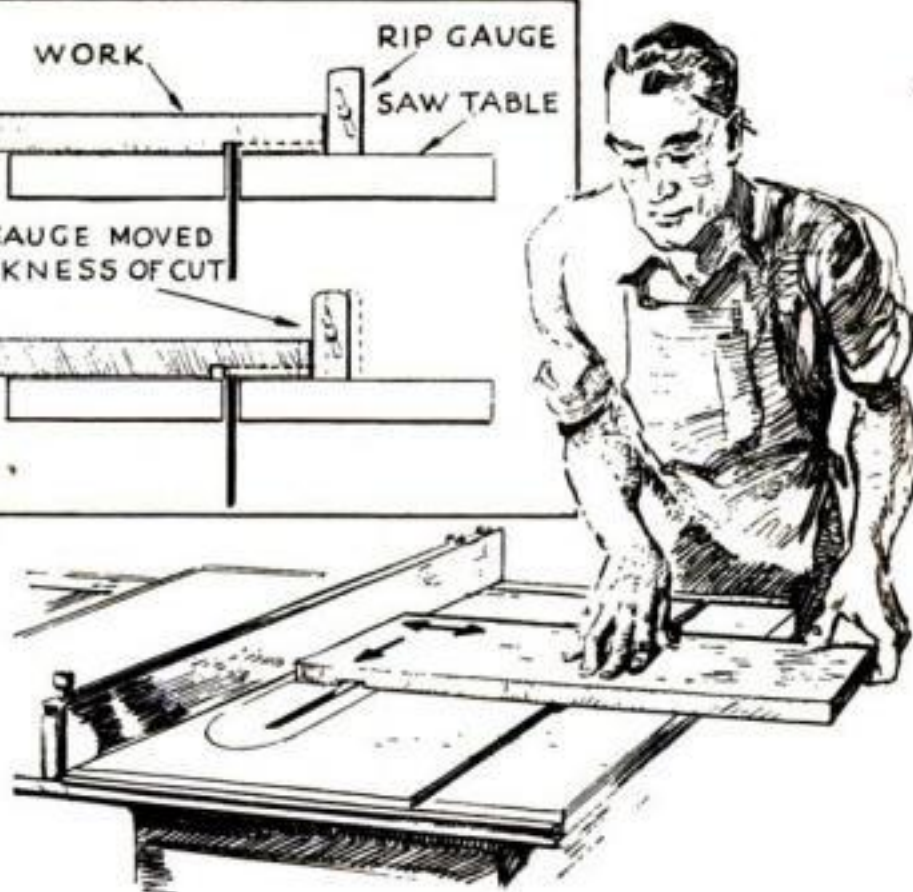
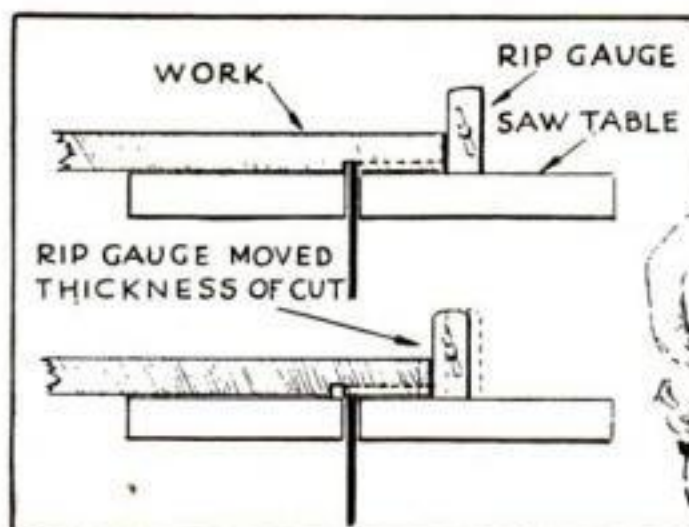


Trick Way to Cut Tenons on a Saw

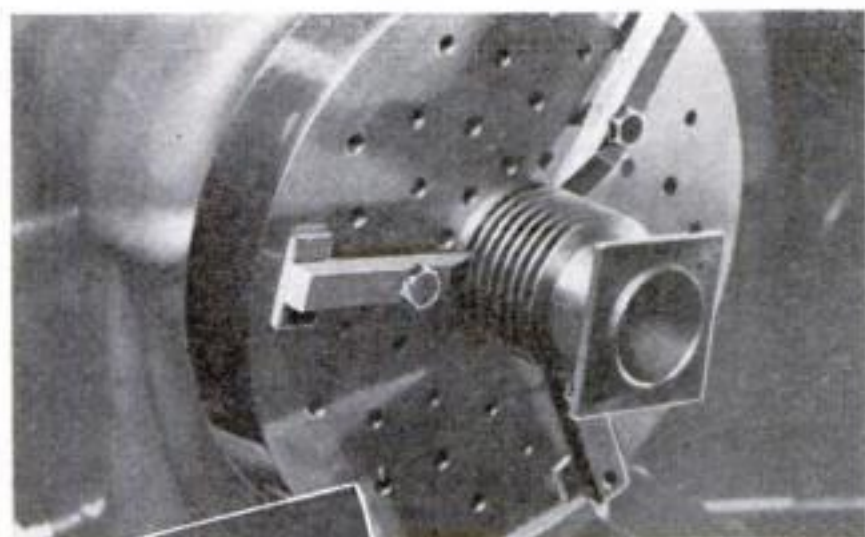
RECENTLY I saw a shop foreman use a method that saves a great deal of time in cutting a few tenons on the circular saw because it is not necessary to take the trouble to set up a tenoning jig or change to a dado head. The saw blade should be thick and stiff, of a small-toothed cut-off type, and turning at 3,600 r.p.m. or more.

Suppose a one-shouldered tenon is to be cut $\frac{1}{4}$ " deep and 2" long. The blade is raised $\frac{1}{4}$ " above the table and the rip gauge set so that the first cut will be exactly 2" from the end. The rip gauge is then moved to the left approximately the distance of the width of the cut just made, or something like $\frac{1}{8}$ ". The cut-off gauge, which has been used in making the first cut, is now removed from the table, and the work is fed into the saw blade by hand. Just as the teeth begin to remove the wood, the work is moved to the left of the entire length of the tenon, and then rapidly moved back until it strikes the rip gauge. These three motions, forward, left, and to the right, are kept up until the tenon is cut, which usually takes only a few seconds.

The blade cuts from the side as well as



forward, and it is because of this that a thick saw blade is recommended. If the work is held firmly, there is no tendency for the saw to throw the work, provided the cut is not too deep. Cuts more than $\frac{1}{4}$ " deep should not be attempted, but should be made by lowering the blade and making two or more passes with the work.—J. B. LEETH.



Clamps Make Straps for Faceplate

THE jaws of inexpensive toolmakers' clamps can be used as strap clamps for holding a variety of small

jobs on a lathe faceplate such as shown above, or for similar work on the drill-press table.—C. W. W.

Heavy C-Clamp Flattens Inaccessible Rivets

SMALL brass, copper, or aluminum rivets in hard-to-get-at places can often be reached and flattened with a husky C-clamp. Place a steel slug between the movable part of the clamp and the head of the rivet so the latter can be placed in the center of the clamp, and even pressure obtained.



KENNETH MURRAY TELLS HOW TO SENSITIZE

IN A NEW YORK store window a demonstrator recently attracted crowds by making photographic prints before their eyes on a variety of materials. He daubed a little solution on the surface where the picture was to be placed and, as soon as it had dried, placed a negative over it, clamped it in position with a piece of glass and a rubber band or two, and exposed the picture to the light of a photoflood bulb for a short time. The picture was then quickly developed and fixed like any ordinary photograph.

Solutions such as he was using can be purchased, but you can make your own quite easily and do stunts similar to those of this

demonstrator. The process to be described is, indeed, even simpler than his. Once you have mastered it, you need not restrict your picture making to photographs on chloride or bromide paper as supplied by the manufacturers, but you can print photos directly on letterhead paper, on the flyleaves of books, or even on tissue paper if you wish, or on glass, cloth, chinaware, wood, metal, or almost any light-colored material.

The surface that is to receive the picture must first be coated with an emulsion that is sensitive to light. It is not difficult to mix suitable sensitizing solutions, provided one does not attempt to compound an emulsion as sensitive to light as are fast bromide-paper emulsions. The chances of turning out a satisfactory emulsion of that type without training and a knowledge of photochemistry would be rather slim. It is for this reason that the writer uses a very simple sensitizing formula, with which it is almost impossible to make an error or have any difficulty.

The formula is a modification of that used in making blueprint paper and gives a blue picture. If desired the blue image may afterwards be toned to sepia (brown) or black. The writer personally prefers blue because of its brilliance and unique appearance.

Solution A:

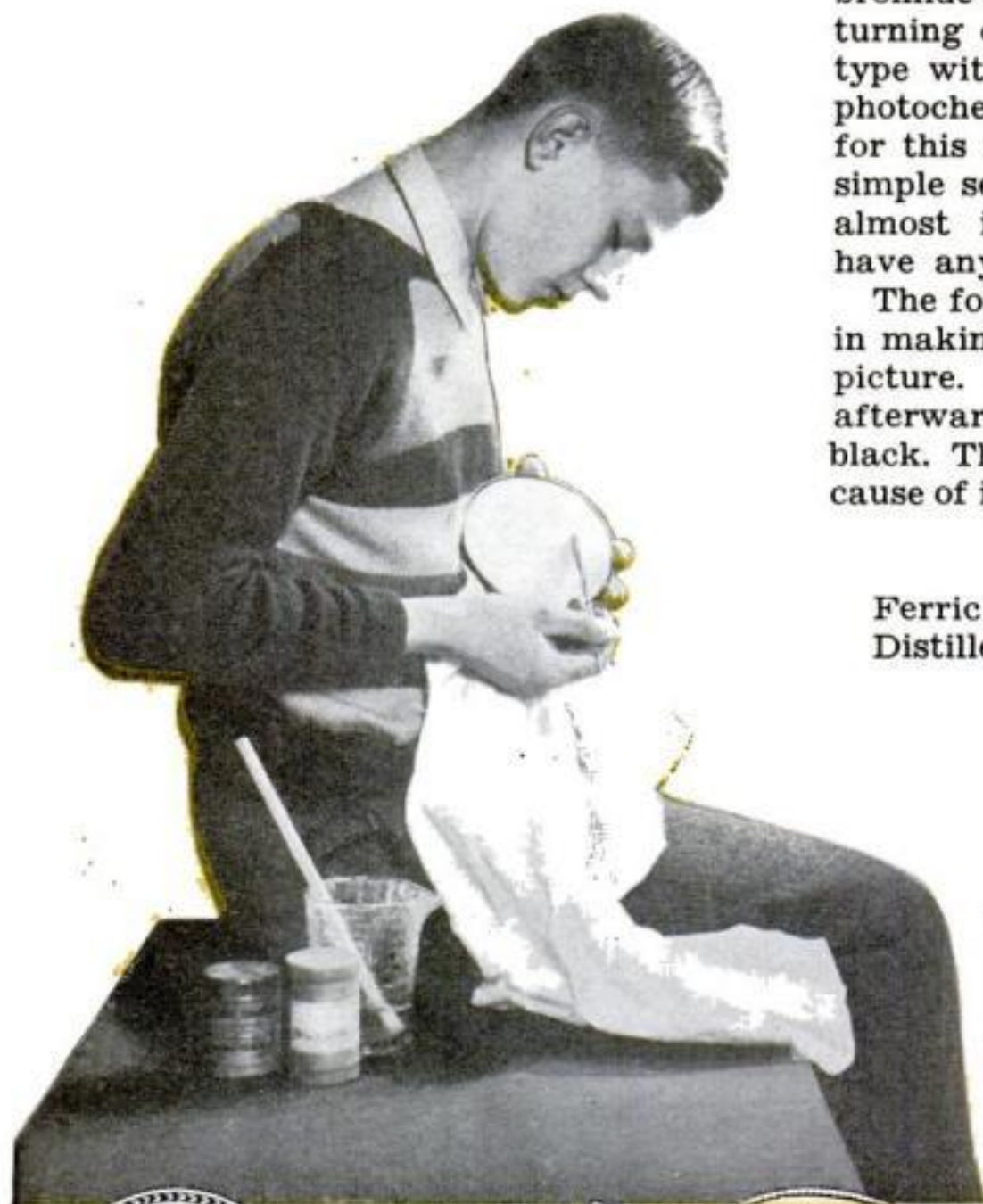
Ferric ammonium citrate 1 oz.
Distilled water 4 oz.

Solution B:

Potassium ferricyanide,
red $\frac{3}{4}$ oz.
Distilled water 4 oz.

Mix an equal quantity of each of these solutions together immediately.

Cloth may be stretched in an embroidery hoop while being sensitized and printed

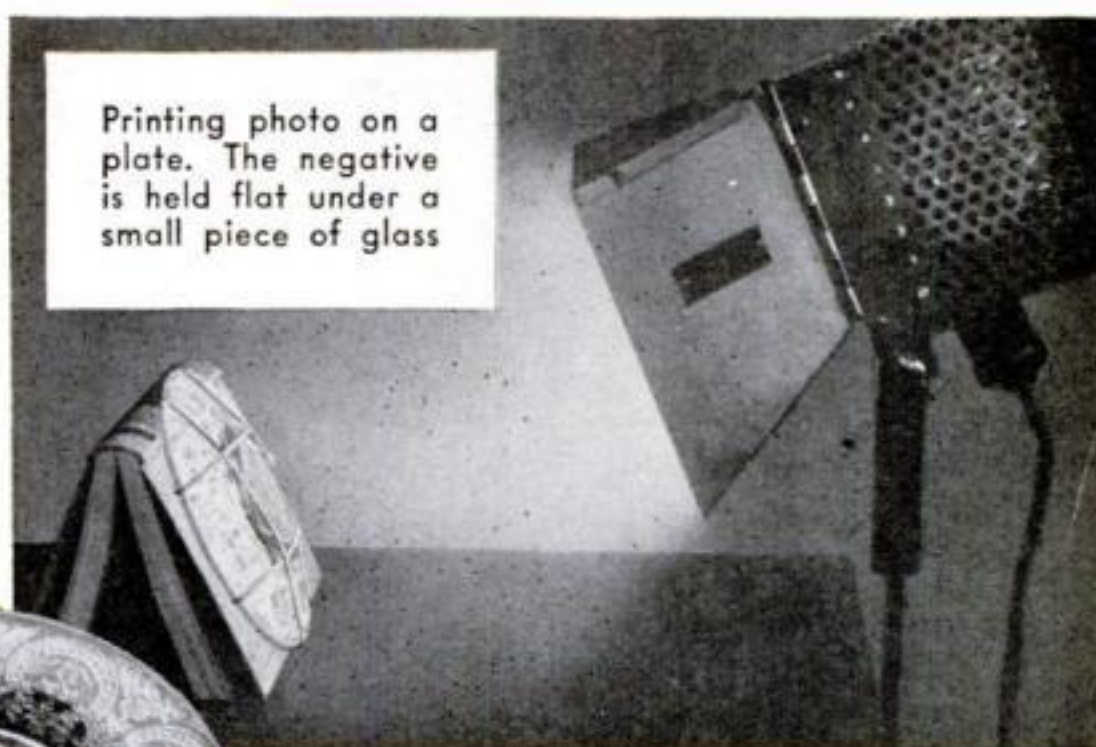


CLOTH, CHINA, GLASS, AND METAL

ly before they are to be used. Apply with a bit of cotton wrapped around the end of a clean stick, and do *not* use a metal-bound brush. Simply swab the solution evenly over the surface of light-colored paper, cloth, leather, wood, or other material. Unless a mask is to be used in printing, the sensitized area should be smaller than the negative. The operation should, of course, be done in a weak artificial light. A yellow or red safelight is not required. Dry the surface as quickly as possible with artificial heat.

Lay a negative over the sensitized spot and hold it in place with a piece of glass to make a good contact. Thin material such as cloth and paper may be held, with the negative, between two sheets of glass. Cloth can be held flat, both for sensitizing and printing, by means of an embroidery hoop. In the case of bulky objects, bind the negative and cover glass in place with cord or rubber bands.

Make the exposure with a photoflood lamp, arc lamp, or sunlight. The latter is much faster. Continue the exposure until the sensitized surface is quite dark in an olive-green color, as seen through the less dense (shadow) portions of the negative. Test exposures



Left, photos on a glass plate and a tumbler.
At top of page, coating plate with gelatin



may be made beforehand on paper if desired.

Development and fixing consist in merely washing the image for a minute in water, after which the picture will stand out brilliantly. The water removes all of the sensitizing chemical that has not been affected by light. In the case of cloth and similar materials, dry the picture by pressing with a fairly hot iron.

In order to apply the sensitizer to "slick" surfaces, such as glass, metal, and plastics, the material must be coated with a thin film of gelatin. Soak one envelope of *plain* dessert gelatin in 3 oz. of water for an hour, then warm it until the gelatin dissolves. Apply the gelatin with a brush while it is warm, and allow it to set and dry thoroughly before coating with the sensitizer. After printing, the washing must be carried on for several minutes to remove the excess sensitizer from the gelatin.

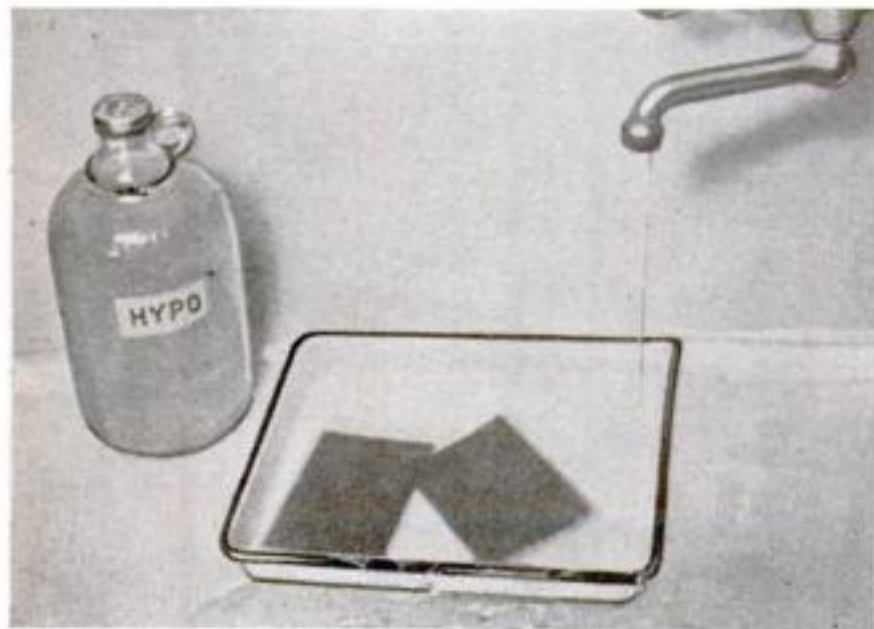
Small Jet for Washing Prints

EFFICIENT yet economical of water, this print washer utilizes an ordinary dish pan and a water jet made by soldering the point of an old mechanical pencil to a piece of copper tubing. The tubing is bent as shown and the end opposite the jet is soldered to a garden-hose repair coupling. The coupling is then attached to a short piece of $\frac{5}{8}$ " hose. The assembly is held on the faucet by means of a clamp obtained from a car radiator and reduced in size to fit. It is tightened by a thumb screw made by soldering a small piece of metal to the screw head.

When the faucet is turned on, a forceful jet of water is directed at one side of the dish pan, causing a continuous whirling movement of the prints. To keep the prints from washing out with the overflow, the pan should be tipped slightly so the overflow is just underneath the water jet.—BENJAMIN NIELSEN.



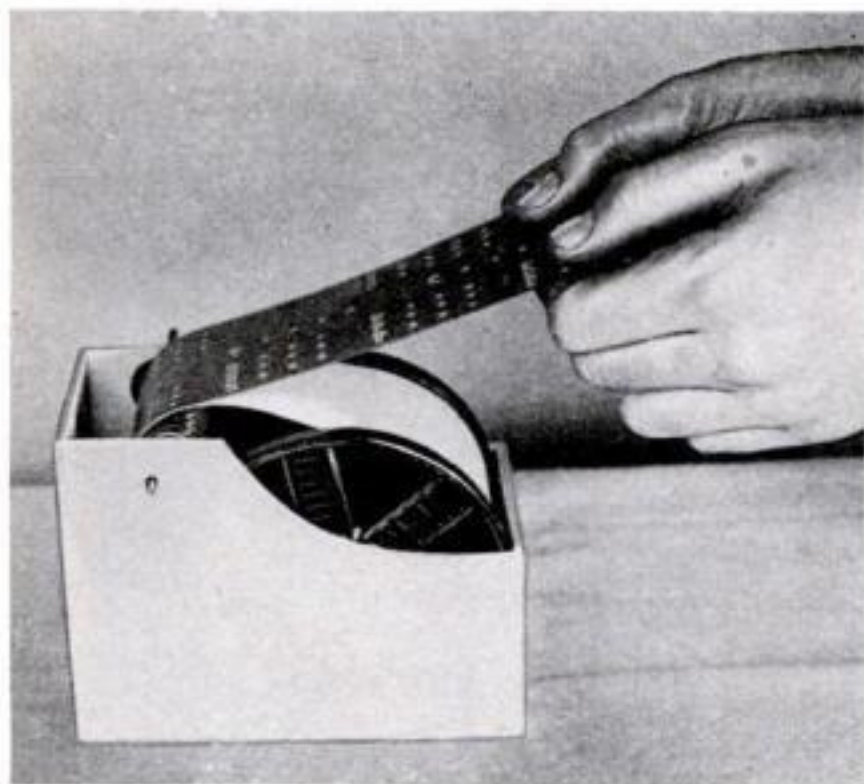
How to Restore Old Hypo-Stained Negatives



NEGATIVES that have not been thoroughly washed sometimes turn yellow later on and become marked with patches of minute yellow crystals of hypo. To remove these crystals without injuring the emulsion, first soak the negatives thoroughly in a fresh solution of plain hypo. Then place the tray containing hypo and negatives under the cold-water tap and allow the water to dribble out. By this process the hypo crystals in the film will dissolve and diffuse out slowly. The film should finally be washed and dried in the usual manner as if it had just been developed.—K. S.

Loading Film in a Reel Without Finger Marks

IN ORDER to eliminate finger prints, buckling, and specks of dust when loading roll film in the reel before development, a heavy cardboard box may be constructed similar to the one shown below. The exposed roll of film is mounted on a wire at the same elevation as the top of the reel. Washers should be placed at either end of the roll to keep it central. Break the seal on the film and pull the paper wrapper toward the right until the film comes out. With the left hand, grasp the film by the edges and insert the end into the open groove of the reel. Keeping the left hand on top of the film to prevent its unrolling, pull the paper with the right hand. This will force the film into the track of the reel.—HERBERT B. WOODLING.



Black Felt on Enlarger Kills Reflections

REFLECTIONS from the polished metal column of a vertical enlarger or the glossy or light-colored base of a horizontal enlarger often cause unwanted dark lines on enlargements. In either case, a piece of black felt will eliminate the trouble.—K. M. S.

CHEMICAL REDUCTION, PART I

[PHOTOGRAPHY]

Reducing formulas fall generally into three classes:

1. *Subtractive*, for use on dense (overexposed), flat negatives. They attack the weaker parts, lessen the general density, and at the same time *increase contrast*. They are excellent for cutting fogged negatives.

2. *Proportional*. These reducers *weaken all densities* (high light and shadow) *in the same ratio*. They will weaken dense negatives with no change in the tone gradation or contrast of the negative.

3. *Superproportional* reducers are used in correcting overdevelopment. They attack the denser silver deposits to a greater degree, thus *reducing contrast*.

A formula of the first or subtractive type is known as "Farmer's reducer." The Agfa formula for it follows:

Solution 1
Hypo—240 grams or 8 oz.
Water to make—1 liter or 32 oz.

Solution 2
Potassium ferricyanide—19 grams or $\frac{1}{2}$ oz. 55 gr.
Water to make—250 cc. or 8 oz.

Mix one part of solution 2 and four parts of solution 1 in thirty-two parts water. Solutions should be stored separately and mixed immediately before use. Solution 2 should be stored in a dark bottle.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

CHEMICAL REDUCTION, PART II

[PHOTOGRAPHY]

A reducer of the second or proportional type is the Eastman Kodak Formula R-5:

Solution A
Water—1 liter or 32 oz.
Potassium permanganate—0.3 gram or 4 gr.
Sulphuric acid (10 percent sol.)—16 cc. or $\frac{1}{2}$ oz.

Solution B
Water—3 liters or 96 oz.
Ammonium persulphate—90 grams or 3 oz.

Take one part A to three parts B. When sufficient reduction has taken place, the negative should be cleared in a 1-percent solution of sodium bisulphite. Wash thoroughly before drying.

A reducer of the third or superproportional type is Gevaert Formula GR 1:

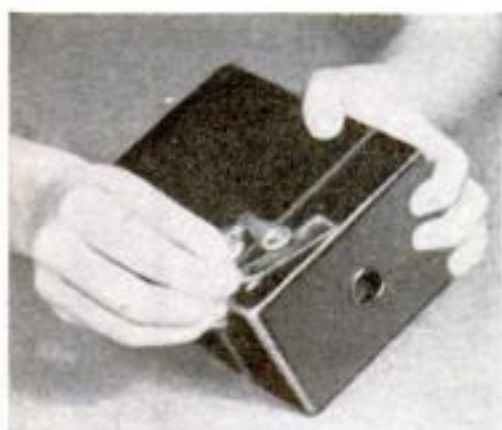
Ammonium persulphate—154 gr. Water—16 oz.
Sulphuric acid—5 drops.

When reduced, place the negative in a 5-percent solution of sodium sulphite for a few minutes. Wash and dry.

Before negatives are placed in any solution such as reducers or intensifiers, they should be soaked in clear water for a few minutes so as to permit the solution to penetrate and work evenly. After negatives or prints have been subjected to chemical action, they should be washed thoroughly. If this be omitted, the chemicals remaining will continue their work, causing patchy, uneven results.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Box-Camera Shutter Taped to Prevent Tripping

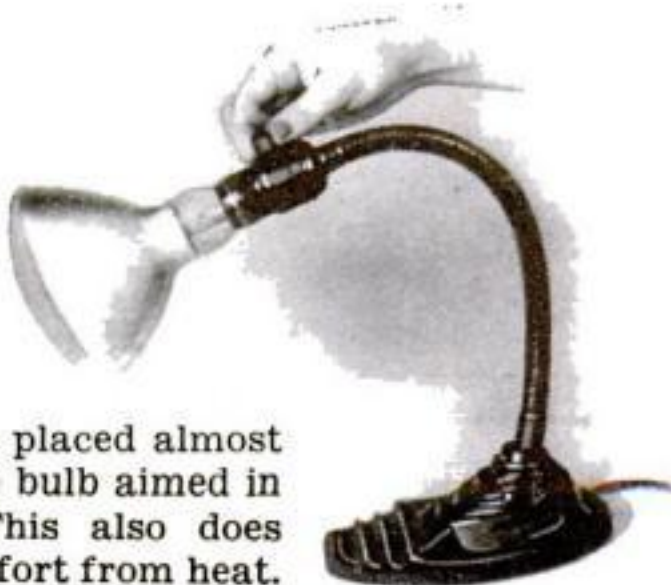


Box cameras are designed to be as nearly foolproof as possible, but sometimes pictures are spoiled because the shutter release is accidentally tripped while the camera is being handled. To prevent this, cut a piece of cellulose

or photo-masking tape about 2" long and lay it across the release. The tape peels off easily and will not hurt the camera's finish.—W. S.

Holder for New Photofloods

BY UNSCREWING the lamp bulb and the reflector from a gooseneck desk lamp, you will have an ideal holder for the new type of reflector photoflood bulb. The desk lamp can be placed almost anywhere and the bulb aimed in any direction. This also does away with discomfort from heat.



Wooden Extension Legs Lift Small Tripod

EXTRA height can be obtained with a small metal tripod by providing a set of extension legs made from wood about 1" square. In the upper ends, bore 6" deep holes of sufficient diameter to receive the legs of the tripod snugly.



Members of the Connellsville (Pa.) Homeworkshop Club teaching the fundamentals of woodworking to a group of boys. Classes are conducted several nights a week at the local Y.M.C.A.

Guild Club Enrolls 100 Children

IN WOODWORKING CLASSES

AN EXTENSIVE program to interest the boys and young men of *Connellsville, Pa.*, in the home workshop hobby is being undertaken by the Connellsville Homeworkshop Club in coöperation with the local Y.M.C.A. Workbenches have been constructed and the "Y" is purchasing equipment. The boys will pay for the tools in small, easy installments, and thus eventually own the tools themselves.

Classes in woodworking are held four nights a week with members of the home workshop club acting as instructors. Nearly 100 boys are enrolled. "This movement keeps the boys off the streets, and we feel we are starting them in a worth-while craft," reports C. W. Syphax, club secretary.

Another project successfully completed by the club was the construction of approximately 500 toys for distribution among poor children. The toys consisted of blackboards for the older children and pull carts and horses on sticks for the younger tots.

Other clubs affiliated with the National Homeworkshop Guild have also been busy with many types of projects. A summary of club reports follows:

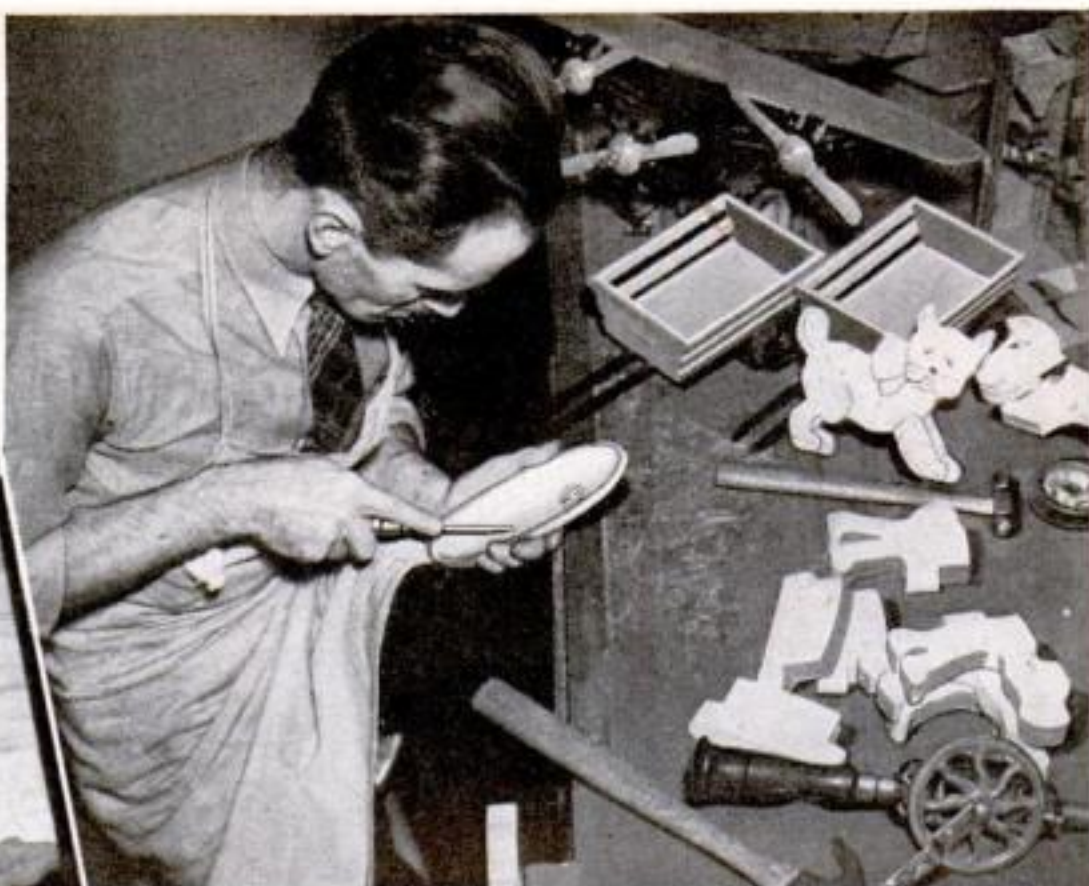
Eight pieces of playroom apparatus were recently completed by the *Saginaw (Mich.)*

Homecraft Club and presented to a local orphanage. Secretary L. E. Foglesong writes, "We combine work with pleasure by meeting in the shops of members, and having a picnic supper of hot dogs, pickles, pumpkin pie, doughnuts, sweet cider, and coffee. It's lots of fun and brings out the members."

Members of the *Whitehall (N. Y.)* Homeworkshop Club have just completed a large cabinet in which to store the club's property. Carl Wing made a bench having a framework of angle iron on which to put a jig saw and lathe.



The *Racine (Wisc.)* Homeworkshop Club has achieved its goal of permanent headquarters. "Most of the credit is due Steve Steible, a charter member and founder of the club," reports Secretary C. W. Hansen. A demonstration



Above, Harold M. Salhoff, of the Bison Homeworkshop Guild of Buffalo, N. Y., making toys to be given to poor children. Left, inlay picture made by John Hough, of the Chicago Craftsmen's Club



Projects made by members of the Ohio Valley Homecraft Club and displayed recently in a Wheeling (W. Va.) store window

on how to prepare and finish wood was given recently.

A question-and-answer program on wood-working conducted by Franklin Robeson at a meeting of the Gem City Homeworkshop Club, *Dayton (Ohio)* proved to be very amusing and entertaining. Many power tools have been purchased in recent months by the members, and some have had to enlarge their shops.

Moving pictures of cutting western pine and shaping millwork were shown to the *Shreveport (La.)* Homecraft Club through

the courtesy of the Shreveport Trade School.

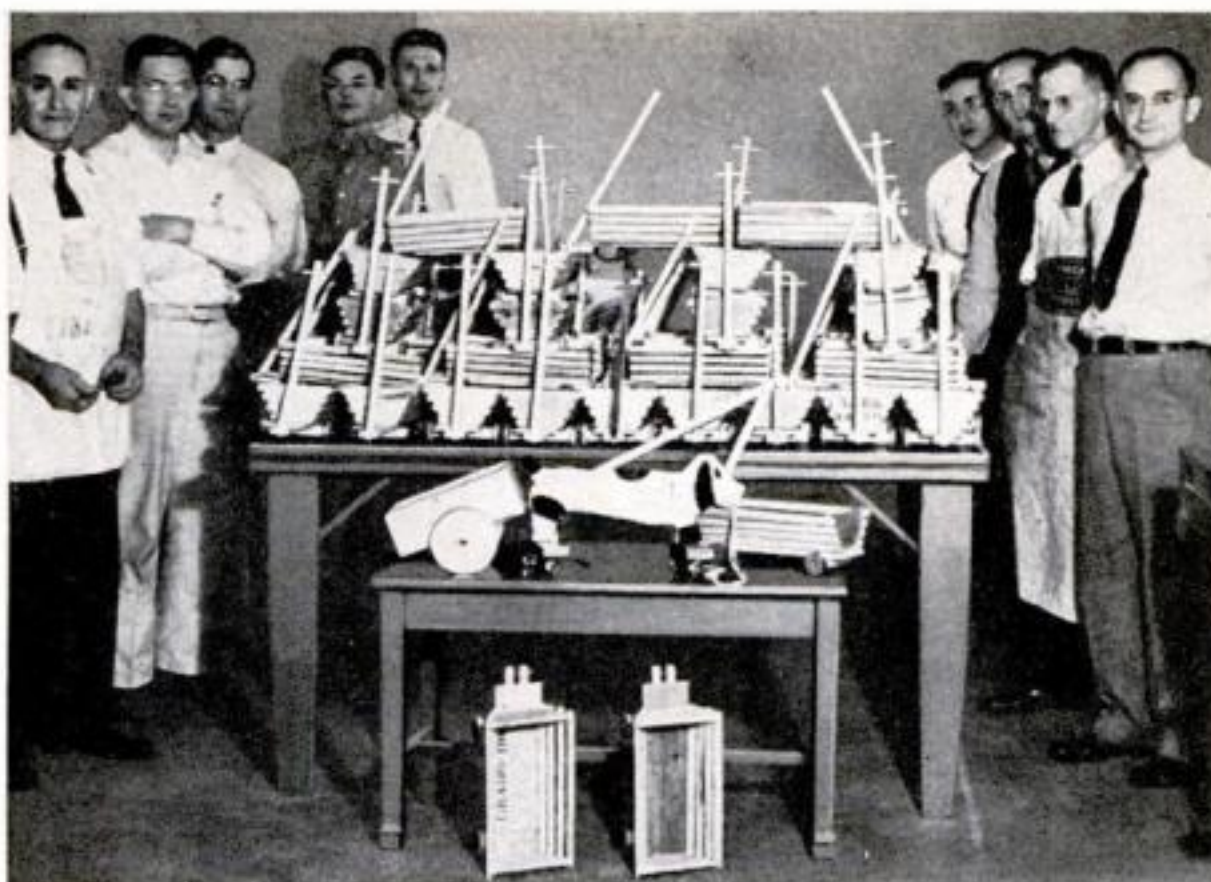
A great deal of interest was shown in the window display arranged by the *Whitby (Ont., Canada)* Craftsmen's Guild in a hardware-store window. . . . The *Cranford (N. J.)* Homeworkshop Club checked up on its members and found that four are manual training teachers, two are mechanical engineers, and eleven are businessmen. . . . "Trees and Men," a talking moving picture, was shown to the *LeRoy (N. Y.)* Homeworkshop Club.

Beach (Va.) Workshop Club won a blue ribbon for its educational exhibit at the Chesterfield County Fair. Costello P. Massey arranged the exhibit and Curtis Hicks

was in charge of the booth.

F. Huggins has been appointed acting president and W. H. Richards secretary pro tem of the newly organized *Mount Dennis (Ont., Canada)* Homeworkshop Club.

Three hundred toys were made by the *Ashland (Ohio)* Homeworkshop Club and distributed to poor children through the local Salvation Army. Dr. Shilling, who was in charge of the project, would bring a completed toy to a meeting, take it apart and discuss it, and then hand each member a piece with instructions to make fifty just



The making and repairing of toys is a civic activity in which nearly every Guild club participates. Above is the Ashland (Ohio) club

like it. At the following meeting the toys were assembled, and another toy explained. This continued for three months.

Dr. Edson R. Brewer explained X-ray photography before the *Peekskill* (N. Y.)

Homeworkshop Club and showed the members how to read X-ray photographs. A moving picture on marquetry and wood inlaying was shown at the home of Theodore Bee.

When the Ohio Valley Homecraft Club of *Wheeling* (W. Va.) held an exhibition recently, the furniture and novelties displayed had such professional touches that many persons thought the exhibit was arranged by a furniture company. Meetings are held at the Department of Public Assistance where the members are allowed to use the machinery. A locker has been built to store the club's plans and records. Local

hardware stores have coöperated by donating tools and supplies to be given as awards.

A moving picture explaining veneer processes and gluing methods was shown to the *Wood-Ridge* (N. J.) Homeworkshop Club.

Get More Out of Your Workshop ... Start a Club

YOU'LL get twice as much enjoyment and profit out of the home workshop hobby if you belong to a club composed of men interested in craftwork. The National Homeworkshop Guild was organized to help bring together amateur craftsmen, like yourself, so that they may exchange ideas, hear talks by experts, see demonstrations of shop methods, and benefit in many other ways. Here is what the Guild does for its affiliates:

1. Issues a charter and presents a copy of "A Manual for Home Workshop Clubs" to each new club.

2. Distributes annual affiliate cards for club members.

3. Gives national publicity to clubs through *POPULAR SCIENCE MONTHLY*.

4. Conducts a monthly photo contest.

5. Sends monthly bulletins of helpful information to club secretaries.

6. Answers letters from club members requesting special information.



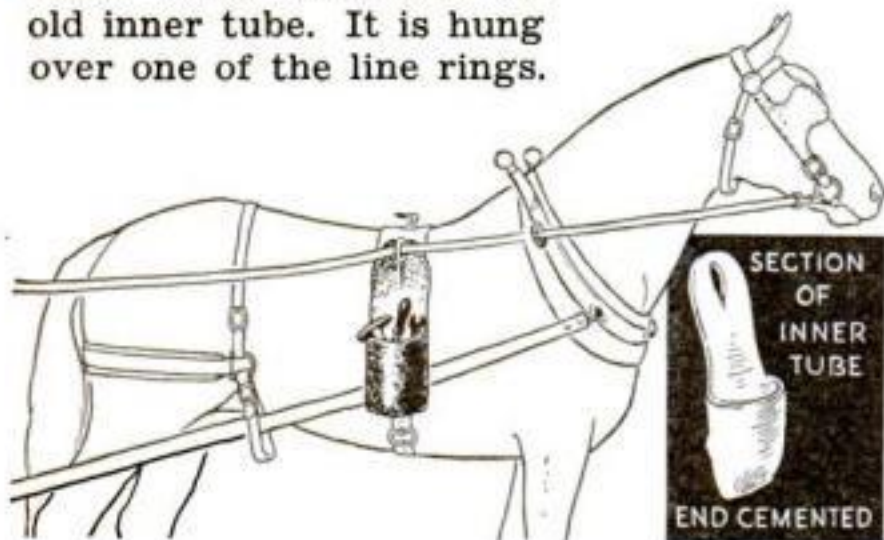
7. Distributes job sheets containing approximately thirty projects each year.

8. Awards three silver plaques annually to clubs outstanding in the fields of civic activities, programs, and craftwork.

The Guild charges no dues, and all of the services listed above are absolutely free. Just send a large (legal size), self-addressed, and stamped envelope to the National Homeworkshop Guild, 347 Fourth Avenue, New York, for complete details.

Small Saddlebag Holds Tools for Field Work

WHEN a horse or team is used in the field on drags, rollers, and other implements that provide no space for a tool box, necessary tools may be carried in a saddlebag made from a section of old inner tube. It is hung over one of the line rings.



The saddlebag hangs over one of the line rings

Metal Record-Book Cover Padded with Rubber

THIN, metal-covered loose-leaf record books can be handled more conveniently by truckmen, messengers, meter readers, and others if three triangular, soft-rubber auto hood guards are used to pad the corners, as shown below. The lower ones keep the sharp edges from cutting the clothing when the opened book is laid on the left forearm for support. The third guard is convenient if it is necessary to grip the edge while bracing the book. Notes written on small pieces of paper can be slipped between the guards and the covers. The guard on the front cover makes the cover easy to lift up.—F. B.



The rubber pads prevent the corners from cutting clothing and afford a place to hold small papers



Airplane Plans Waxed to Prevent Sticking

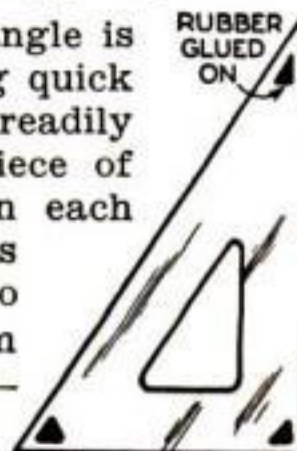
TRANSPARENT paper is often included with model airplane kits to be placed on the full-size plans so that parts can be assembled over them without having the cement stick to the paper. A more convenient and effective method is to rub paraffin wax directly on the plans.—TED KELLER.

Electric-Clock Connections Hidden in Special Outlet

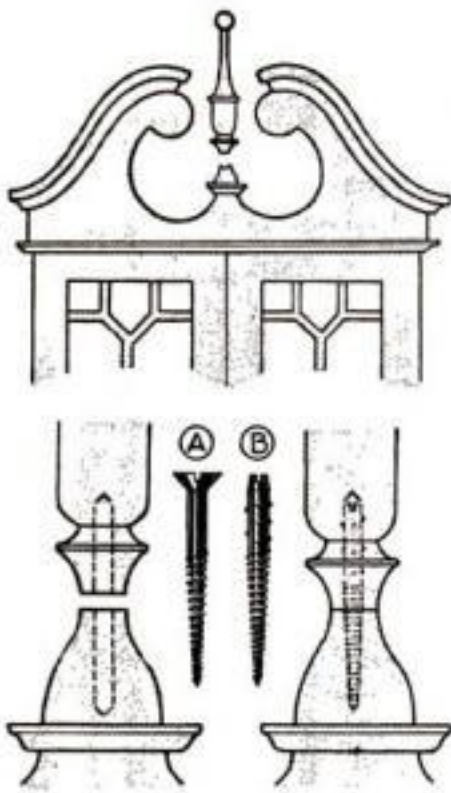
WHEN a new outlet is to be installed for an electric clock, it is desirable to select a type that may be placed directly back of the clock. These special clock outlets are recessed so that the cord and plug do not project beyond the surface of the wall and are therefore completely hidden. They should be used with the same kind of switch box required for regular base and wall receptacles. It may be necessary to shorten the cord connected to the clock a little in order to enable it to be coiled in the somewhat limited space provided by the recessed outlet.—H. P. S.

Thin Rubber Pads Prevent Triangle from Slipping

A CELLULOID drafting triangle is often used alone for making quick sketches. It will not slip so readily on the paper if a small piece of thin rubber is cemented on each corner, and this also makes the triangle much easier to pick up and move about from one position to another.—CHARLES HOMEWOOD.



Dowel Screw Reinforces Furniture Joint



An example of how the spindle on a furniture piece can be repaired by means of a screw used as a steel dowel

WHEN ordinary double-pointed steel dowel screws are not available for making furniture repairs, a substitute can be prepared from a 2" No. 10 flathead wood screw. Grind off the head until it is flush with the straight part, and nick the shank with a sharp cold chisel to give it a barblike effect. Drive the screw into the lower part of the joint so far as the threads reach and use the extending peg as if it were a wooden dowel.—JOSEF N. PETERSON.

Finger Coil Improves Paint-Pail Hook

NEXT time you make a wire hook to hold a paint pail on a ladder, wrap the wire around a piece of broom handle to make a coiled finger loop as shown. This will permit the pail to be lifted and carried with ease and comfort.—G. E. H.



Initial Book Ends Sawed from Thick Pine

PERSONALIZED book ends may be made by cutting the initials of your first and last names out of thick white pine and coloring them to simulate gay festaware or onyx. Draw the initials on heavy cardboard, cut them out, and trace the outlines of the templates on clear white pine stock about 2" or 3" thick. Then cut the book ends out on a band saw or jig saw or by hand, and sand all corners. Bore large holes in the base of each letter and fill with molten lead to provide extra weight and stability. Enamel them any desired color or colors and glue felt or blotting paper on the bottom to prevent marring the table. These pieces also can easily be adapted to make excellent door stops.—GEORGE E. BASICH.

Dog's Buffet Provides Space for Three Dishes



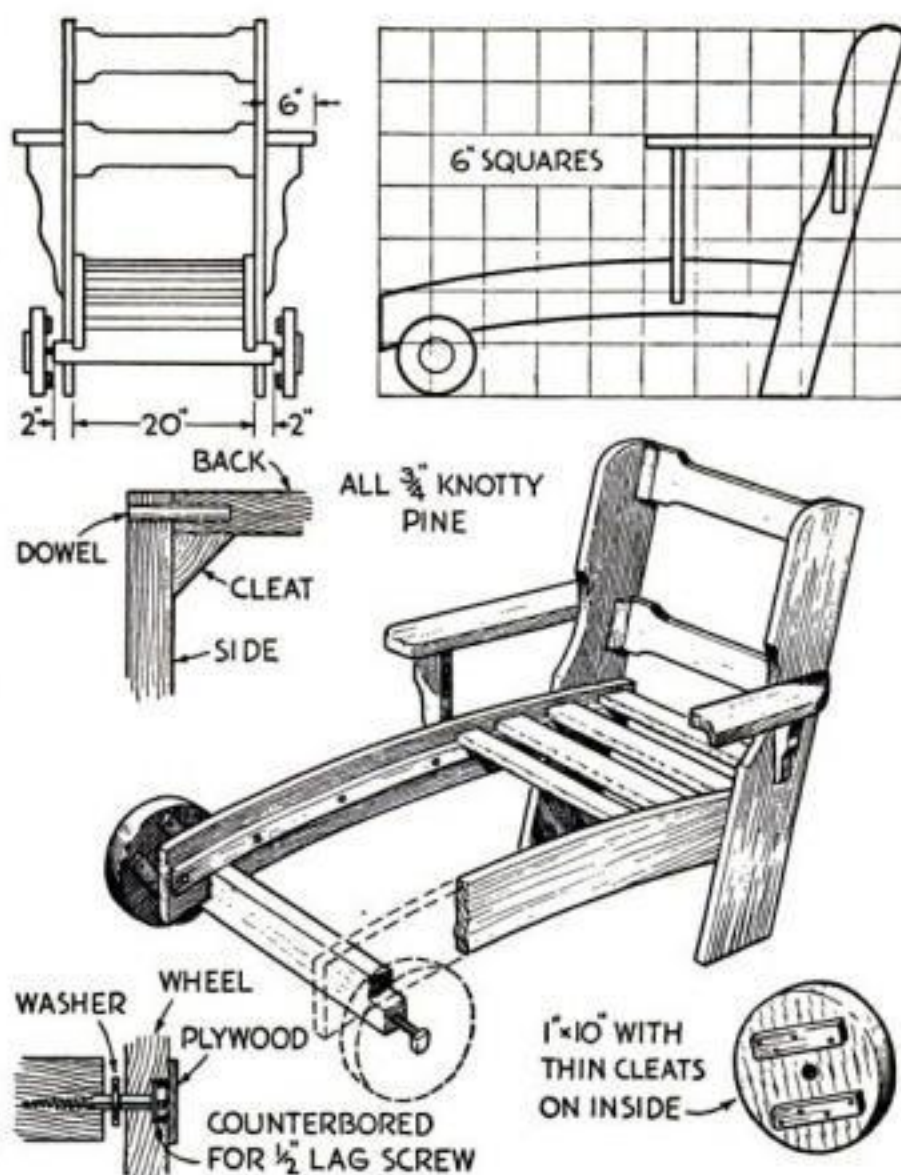
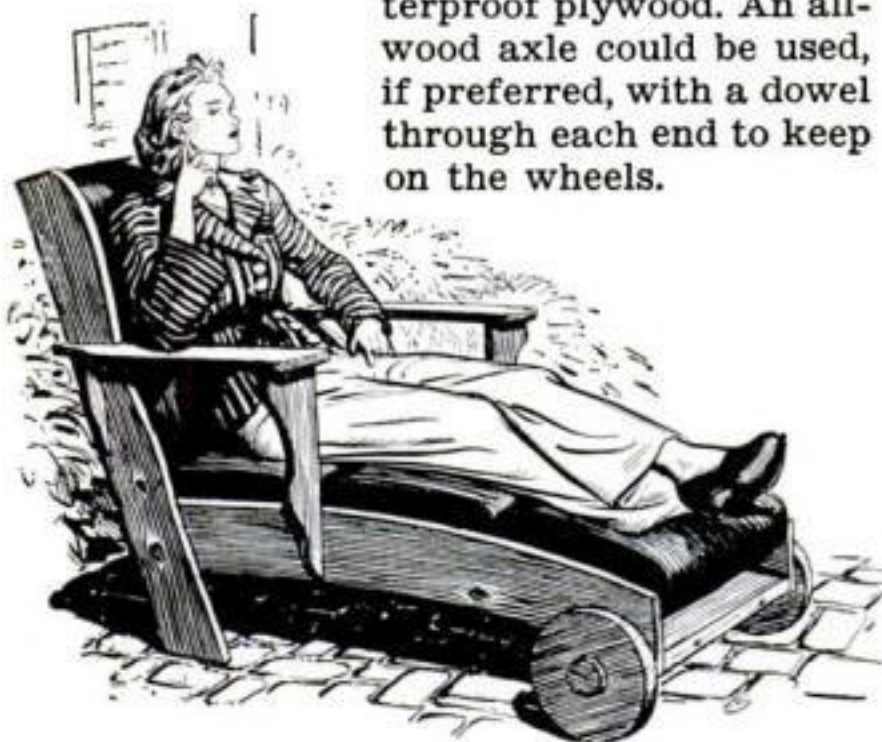
THIS buffet or dish holder was designed to prevent *Judy*, shown above, from tipping over her food dishes. Draw the design on a piece of $\frac{3}{8}$ " by 11" by 22" plywood with the name of the pet set in the space provided for it. Jig-saw or cut by hand the

back and the dish openings in the tray section. Use a light shade of gray so as to avoid too much contrast to the white. Nail the tray to the back after the painting is finished on both pieces.—H. F.



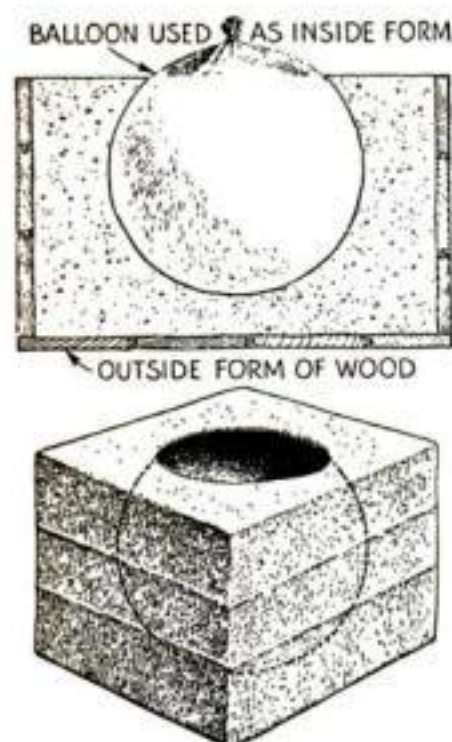
Patio Roll-Around Built of Pine

HERE is a patio roll-around couch that can be built with only a few hand tools. The original is of $\frac{3}{4}$ " (net) knotty pine, assembled with galvanized screws, dowels, and casein glue, and finished with linseed oil. The side members of the bed frame are screwed from the inside to the uprights for the back, and the cross members of the back are doweled to the uprights and glued to three-cornered cleats. The wheels turn on lag screws with heads countersunk and covered with disks of waterproof plywood. An all-wood axle could be used, if preferred, with a dowel through each end to keep on the wheels.



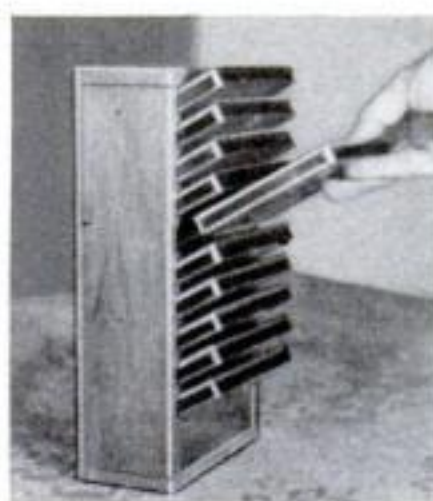
The wheels turn on lag screws with the heads countersunk and covered with plywood disks

Dogs' Drinking Basins Cast Around Balloons



A KENNEL OWNER wanted to cast some cement drinking basins of the approved type having a small opening to prevent slopping. These required an inner form that would give the right shape, yet be easy to withdraw. He found that toy balloons answered the purpose perfectly.

In order to prevent a break in receiving issues, subscribers are requested to notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address.



A Cabinet for Holding Flat Tins

A CONVENIENT holder for flat cigarette tins may be easily constructed as shown. The metal boxes may be painted, if desired, and used for storing any small articles in the home, office, shop, or darkroom.—RAY BLAIN.

Resharpening Cutter Wheel

GLASS cutters can be sharpened by holding the small cutter wheel to a high-speed grinding wheel for an instant. The wheel need be ground only on one side, but the original bevel should be retained.—C. W.



Stove of Coffee Maker Heats Small Flasks



THE small electric stove that comes with some of the newer glass coffee makers can be put to other uses than that for which it was intended, provided the housewife has no objection. In the home laboratory it will serve for heating flasks, beakers, and other apparatus. It heats quickly and efficiently, and is easily carried about because of its size.—CHARLES L. COTTRELL.

Magnetized Punch Holds Tiny Brads

SMALL brads can be driven into inaccessible places or awkward corners with the aid of a magnetized pin punch or large nail set, as shown. The punch can be magnetized by rubbing it a few times against a horseshoe magnet.

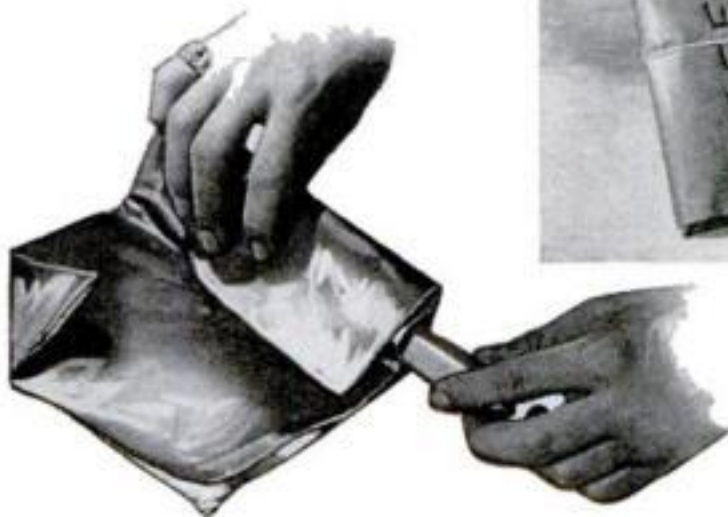


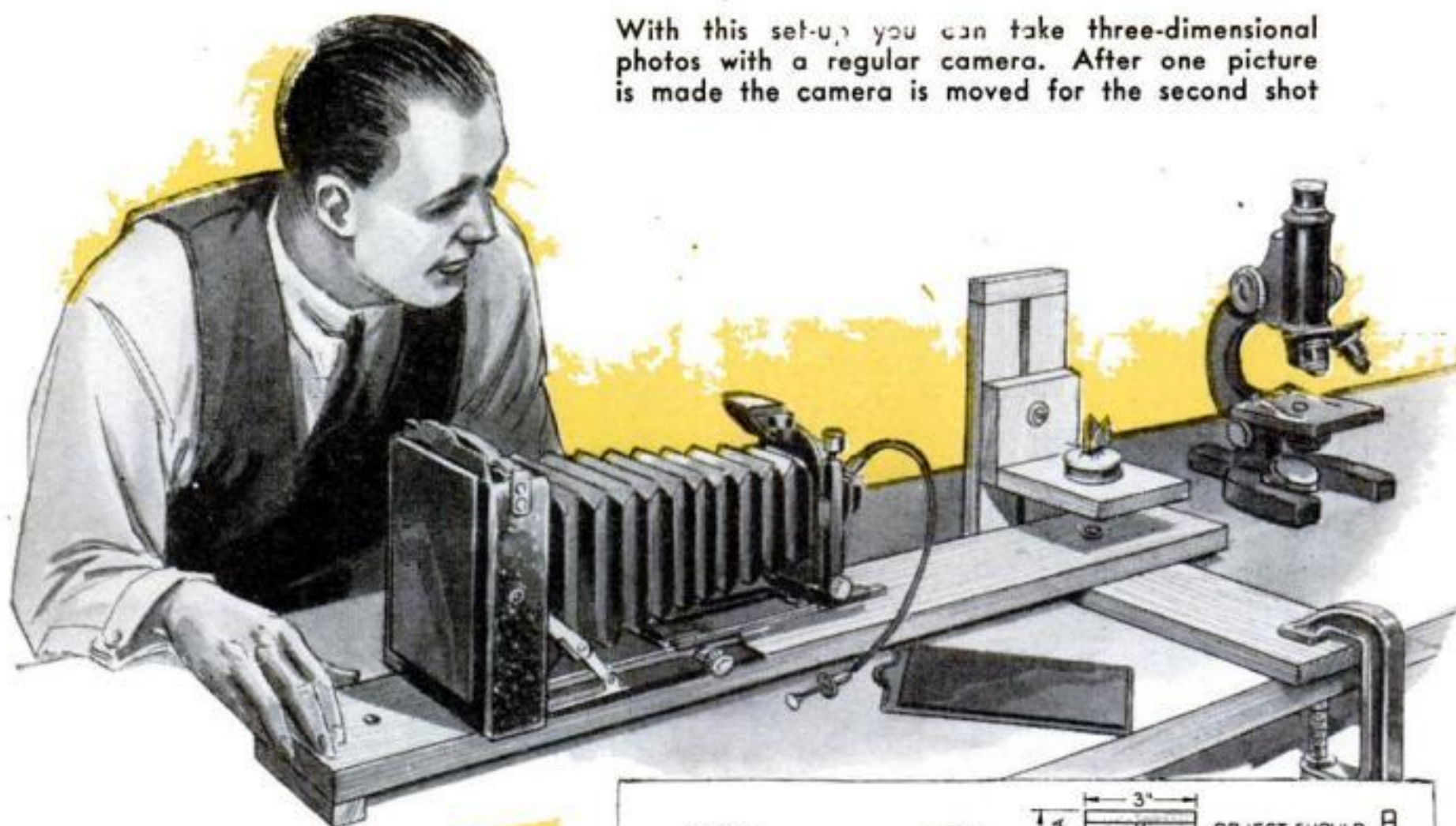
Holding a Flash Light for Awkward Work

OFTEN when one is working with a flash light in a dark corner, especially on awkward or overhead jobs, it is necessary to use both hands, and the matter of holding the flash light then becomes a problem. One way to do it is to loosen the necktie sufficiently so that it will fit over the head and slip the flash light under it, as illustrated above.—L. H.

Foil Wrapping Preserves Paintbrushes

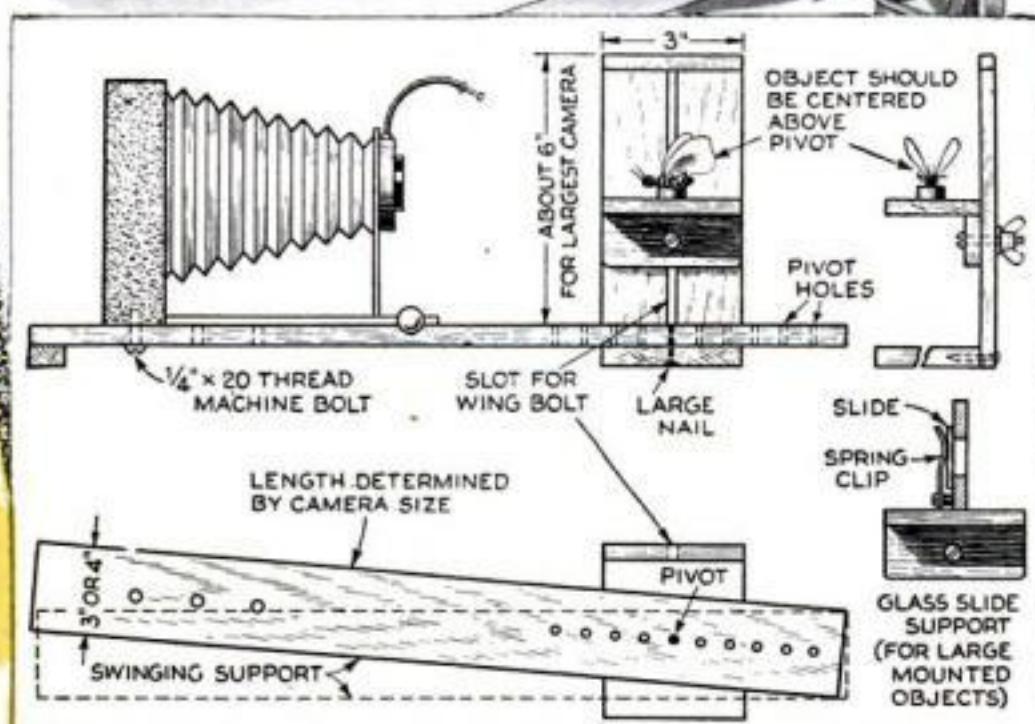
PAINTBRUSHES can be kept soft and pliable from day to day or even for periods of several weeks by the method illustrated. They are first wrapped in a small piece of cloth, and a little turpentine is applied. Then each brush is wrapped in a sheet of aluminum foil such as that used in packaging photographic film. This makes a nearly air-tight cover.—A. J. VIKEN.





With this set-up you can take three-dimensional photos with a regular camera. After one picture is made the camera is moved for the second shot

Solid Pictures WITH YOUR MICROSCOPE



Scrap lumber can be used to make the camera holder

ONE of the most fascinating things the amateur microscopist can do is to study and analyze magnified objects by means of stereograms—twin photographs which when properly viewed show the objects in three dimensions.

Many microscope amateurs and camera fans do not attempt to make stereoscopic pictures because they think them difficult. Actually stereo photos of small objects are scarcely more troublesome to make than ordinary kinds.

A stereogram, or stereograph, consists of two pictures, one showing the object as the left eye would see it, and the other as the

right eye would see it. These pictures are placed side by side and viewed in such a way that they appear superimposed. The brain of the viewer then does the rest by making the two pictures fuse and appear as if a three-dimensional solid were being observed.

Twin-lens stereo cameras like those employed for ordinary snapshotting are not used in recording small objects, except with binocular microscopes. When the objects being photographed do not move, as is usually the case, two successive exposures on different films or plates are made, with either the camera or object being shifted the required amount between shots. Some stereoscopes are designed for viewing transparent positives on glass, while the more common type, including the kind Grandmother used to keep on her living-room table, is used to look at prints on paper. In either case, the pictures are mounted side by side, with the separation between any

pair of similar points being from about $2\frac{3}{8}$ " to $3\frac{1}{4}$ ", the best separation depending somewhat on the design of the stereoscope. Each picture of a stereo pair may be anywhere up to about 3" square, when the pair is to be observed with a common American stereoscope. In mounting stereo pairs, the left-eye view should go on the left and the right-eye picture on the right. The best way of determining which is which is to put a blank card in the stereoscope and lay the prints in their approximate positions. If you get them reversed, you will observe that the background seems to stick out in front, which of course is bad. By shifting the pictures around a bit, you can find the positions where they are in alignment, and the correct distance apart. Fasten them there with rubber cement, or photographic dry-mounting tissue. A dark-colored cardboard is best for the mounts.

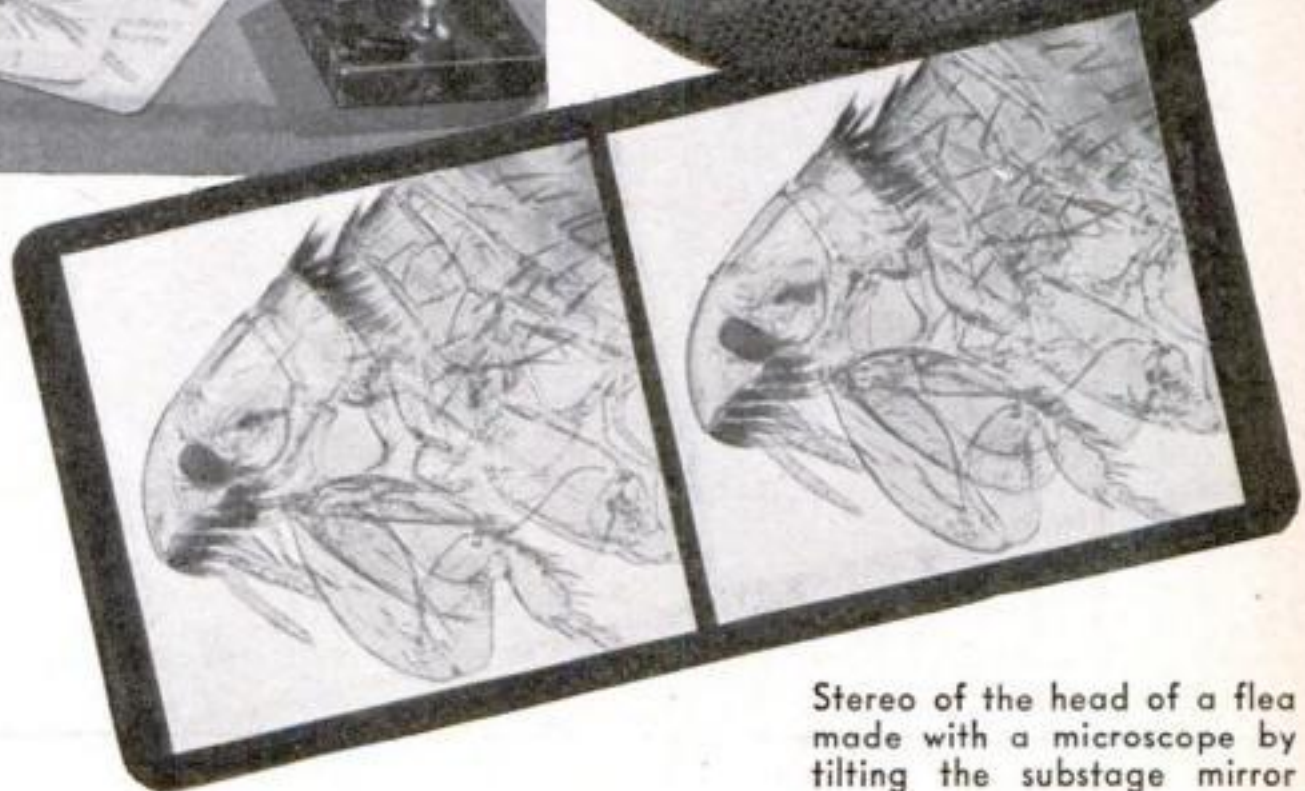
A picture that is soft and full of detail rather than contrasty is best for a stereograph. For this reason, ordinary films or plates are preferable to the special photomicrographic plates and others that give high contrast. For top-lighted objects, arrange the illumination to avoid dense shadows. In taking the picture, try to get as great a depth of focus as possible.

To do this with a photographic lens, use a small diaphragm opening. With a compound microscope, put a black paper washer over the upper lens of the objective to act as a diaphragm. When a substage condenser is used, racking it down will increase the focal depth. Closing down the substage diaphragm, with the condenser up against the stage, has the same effect.

You do not have to use a microscope to make magnified stereo photos of small objects. For magnifications of a few diameters, an ordinary camera lens can be used, provided it is mounted so that it can be racked out more than the normal distance from the film. Many present-day cameras, particularly miniatures, can be provided with extension tubes that move the lens out from the film and give magnifications ranging up to fifteen or so diameters. Further magnification can be produced through enlarge-

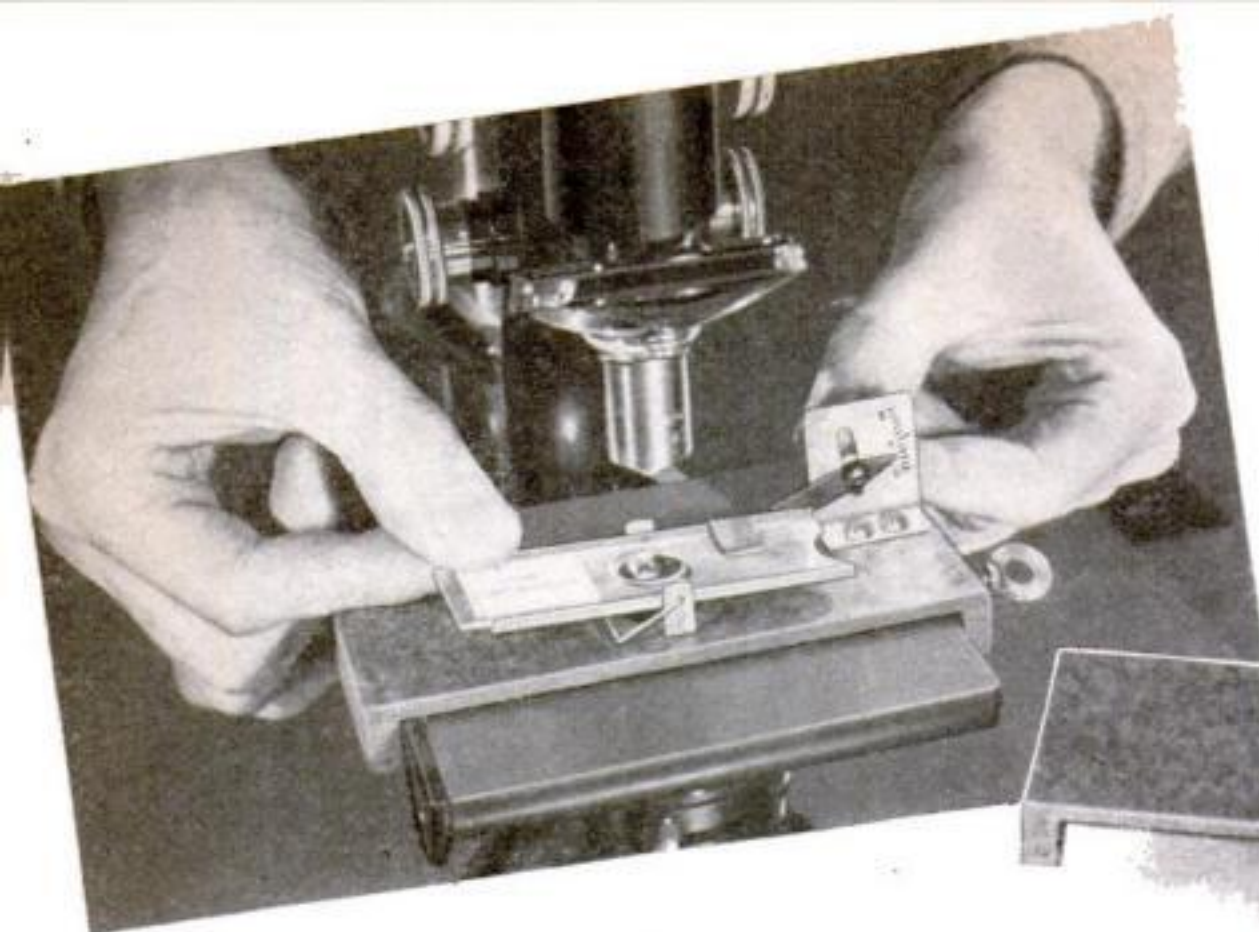


Dry-mounting tissue is being used above to mount a pair of stereo prints for viewing with the familiar old-fashioned-type stereoscope



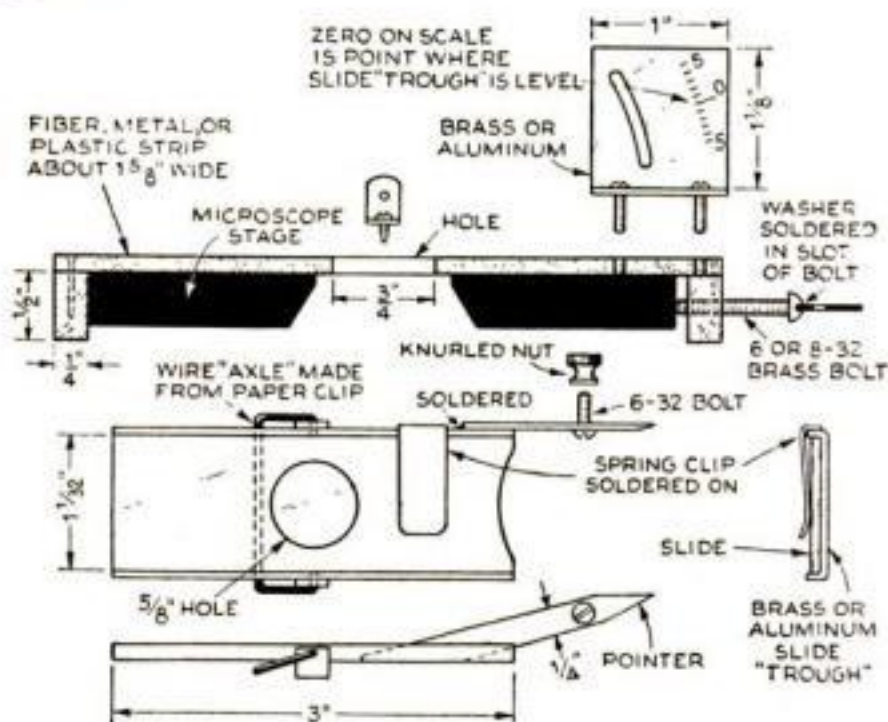
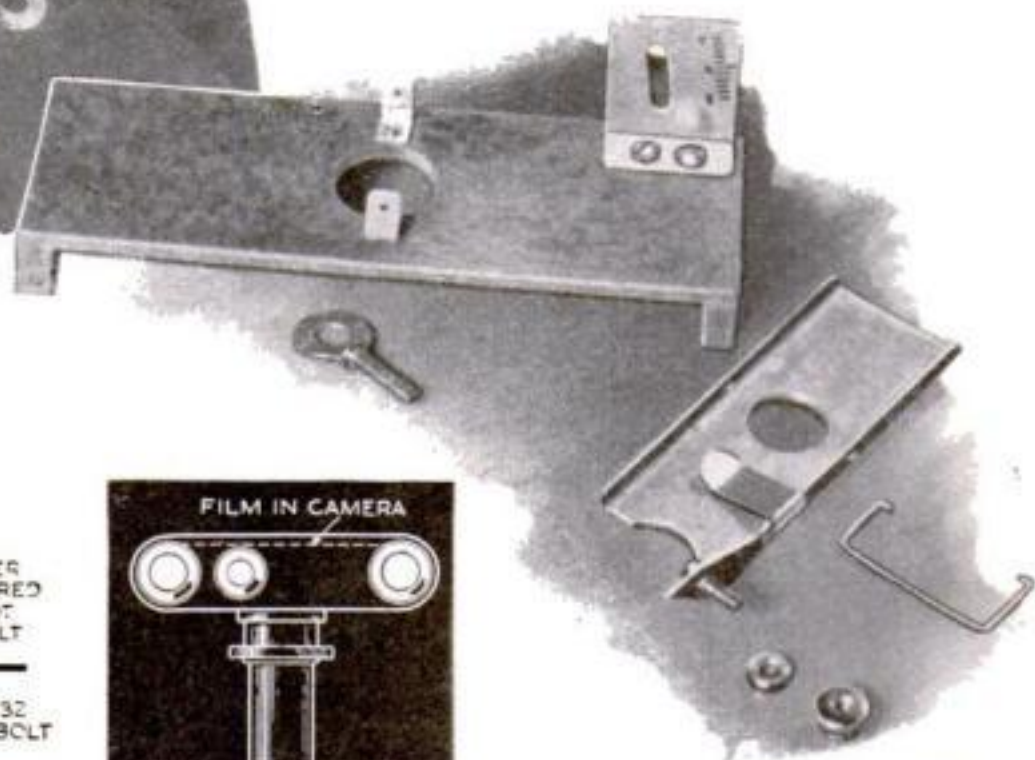
Stereo of the head of a flea made with a microscope by tilting the substage mirror

By
**MORTON C.
WALLING**



STEREOS WITH YOUR MICROSCOPE

are most easily made with this simple unit fashioned out of sheet metal. The diagram gives the dimensions of the separate parts. In use, the slide is placed on the special holder which is then tilted slightly to one side. After making one exposure, the holder is tilted in the other direction and the second photomicrograph is made



ment. Bellows-type cameras having double or triple extensions, aided perhaps by auxiliary "copying" lenses, will enable you to make life-size negative images; and a great deal of interesting material can be recorded at this magnification—insects, shells, small flowers, seeds, and so on. Still another stunt is to fit a short-focus lens to a relatively large camera. Thus a lens of 1" or 2" focus, mounted on the lens board of a 4" by 5" camera, will give considerable magnification at full bellows draw. Further magnification can be obtained by mounting the lens in one end of a large cardboard tube and the camera at the other, the tube being painted dead black inside.

Whatever the type of equipment you use for making stereograms at low magnifications, you must shift either the camera or the object between exposures. Since any movement of the object usually alters the lighting, only the camera-shifting method will be considered here.

A rough and ready way of making a stereo pair of exposures at close range is to set up the camera, focus, and make the first exposure. Then slide the camera sidewise along a line parallel to the plane of the object on which you focused, swing the cam-



era lens around until the object is again centered on the film, and make the second exposure. Thus you obtain two views of the same thing, from slightly different angles.

It will pay you to rig up a simple mount to swing the camera with greater precision. Get a board 2" or 3" wide, and long enough to extend from the object to the farthest camera position you will use, and

either slot it or bore a series of holes so that the camera can be fastened at various distances from the object. Bore a hole near one end of the board for a screw or nail that will serve as a pivot. Directly above this pivot, arrange a small platform on which you can place the object to be photographed. A vertical stage with a hole in it, and provided with two spring clips can be arranged for holding slides bearing objects. The level of the object should coincide with the axis of the camera lens.

To make a stereoscopic pair of pictures, swing the camera to the left (or right) of center, and make the first exposure. Then swing it an equal distance to the right (or left) of center and make the second exposure, using the same lens aperture and shutter setting. The distance you swing the camera between (Continued on page 242)

HOW'S IT MADE?



PUTTING
CHEMISTRY
TO WORK
IN YOUR HOME
LABORATORY



Trying out a sample of cold-water casein paint made in the home laboratory. Casein, produced from skimmed milk, is the vital ingredient

BOTH builder and wrecker, a chemist resembles a Jekyll-and-Hyde sort of person. In the rôle of an analytical chemist, he tears materials apart to see what they are made of. As a research chemist, he puts compounds together to make useful new products to satisfy many human needs.

In your own home laboratory, you will find it entertaining to repeat some of the notable feats of

professional research chemists. Among other things, you can make a sample of composition flooring; produce colloidal graphite just as Edward Acheson, famous electrochemical pioneer, did; and manufacture a powder valuable to gardeners for protecting seedlings. You

will require a minimum of apparatus for the experiments described here, and the chemicals you use in all of them may be of the "technical" grade, rather than the more expensive, "chemically pure," grade.

Floors in many homes and offices consist of a troweled-on plastic composition called

By
RAYMOND B. WAILES



An interesting exhibit for your chemical museum is a demonstration block of magnesite flooring of the type used in many homes and offices. Here the compound is being spread upon a prepared block of wood



With aluminum foil and a special chemical solution, you can demonstrate the principle of the chemical heating pads employed in beauty parlors

"magnesite flooring" or "Sorrell cement." Its chemical composition resembles that of cement or plaster of Paris, but it has greater resilience than a concrete floor, and its springiness is increased by incorporating wood flour or asbestos in the mixture.

To make a sample of this product for your chemical museum, nail small strips of molding around a wooden block about four by six inches, with a piece of wire screen tacked upon it to help make your composition adhere.

Next you will need a solution of magnesium chloride, with a specific gravity of 1.25. You can approximate this by dissolving twenty grams (about four teaspoonfuls) of magnesium chloride crystals in twenty cubic centimeters (about six teaspoonfuls) of wa-

ter. Or you can use a storage-battery hydrometer in making up the solution, and add more magnesium chloride crystals, or more water, until the desired reading of 1.25 is obtained.

Now take some dry magnesia (magnesium oxide) and mix enough of it with the solution to make a thick paste. At this point, if desired, sifted sawdust may be added to make the product more resilient, and colored pigments may also be included. Trowel the mixture into the recess in your prepared block, and allow it to set. In a day or two it will be found to have hardened. Chemically, the resulting compound is magnesium oxychloride, formed by a reaction between the magnesium chloride and magnesium oxide.

If you prefer to make your own magnesium oxide for this experiment, add a solution of sodium bicarbonate to a solution of



Grinding pencil "leads" with a liquid containing tannic acid to make colloidal graphite. Drawing at left shows set-up for seeing the "Tyndall effect" made by light reflected by suspended particles

Epsom salts (magnesium sulphate). A precipitate of basic magnesium carbonate will be formed. Wash the product well by decantation, or by repeatedly adding and pouring off fresh water, and then recover the precipitate by filtration. Heat it strongly in an evaporating dish, and it will be converted into magnesium oxide.

After making composition flooring, you may be interested in trying your hand at producing cold-water paint for walls. Casein, made commercially from skimmed milk, is one common ingredient. Others are lime, coloring matter, and a preservative.

TO make white cold-water paint, mix up twenty-five grams apiece of casein, lime, and whiting, together with about a gram of borax. (Solid chemicals average about five grams to the teaspoonful.) Grind the ingredients well in a mortar, with a pestle, and then add just a pinch of blue pigment, such as household bluing or ultramarine blue. This masks the yellowish tint of the casein and makes the paint look whiter. Add water to the contents of the mortar and continue grinding, until the entire batch has the consistency of paint. You now have a homemade cold-water paint, which you can try out by applying it with a brush to a sheet of cardboard.

In making the paint, the lime dissolves the casein, with the assistance of the borax. The product, calcium caseinate, serves as a binding for the pigment, which in this case is the whiting. The borax also acts as a preservative.

By substituting titanium oxide for part of the whiting, you will obtain a much whiter product. Cold-water paint of different colors may be made by substituting various insoluble pigments for the whiting. Burnt sienna, an oxide of iron, will give a brown paint; lead chromate, a yellow paint; and chrome green, a green paint.

Making colloidal graphite offers a home-laboratory experiment with an interesting history. About thirty years ago, Edward

Acheson produced a new type of liquid lubricant. Struck by the remarkable lubricating properties of graphite, he had sought a way to keep particles of it suspended in water or oil. He finally succeeded by grinding the graphite with liquid containing tannic acid.

You can duplicate his feat with a piece or two of the "lead" from an ordinary lead pencil, which actually consists of graphite, clay, and wax. Place about an inch of the lead in a mortar, with twenty-five cubic centimeters of water. Grind for about five minutes, and then pour the liquid into a test tube. The graphite will settle to the bottom in about fifteen minutes.

Now put another inch of pencil lead in the mortar and add the same amount of water as before, plus a pinch of tannic acid. Grind for five minutes or longer, and pour into a fresh test tube. This time you will observe that the graphite does not settle to the bottom of (Continued on page 244)



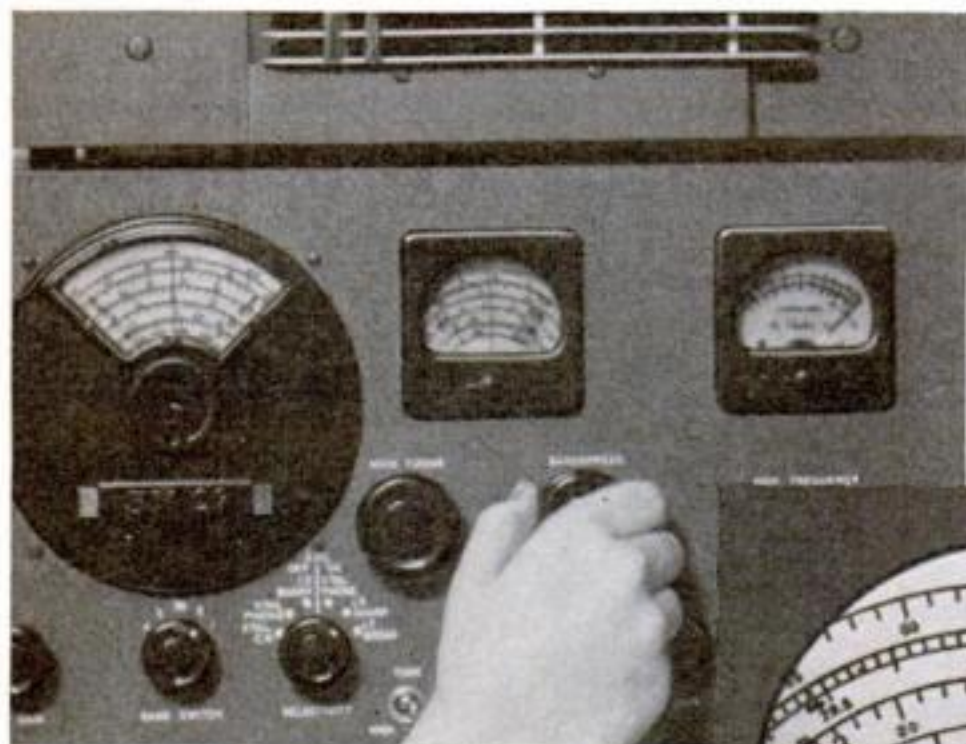
If you are a gardener, you will have use for red cuprous oxide, being prepared above. It prevents a plant ailment called "damping off"

NEW IDEAS FOR THE

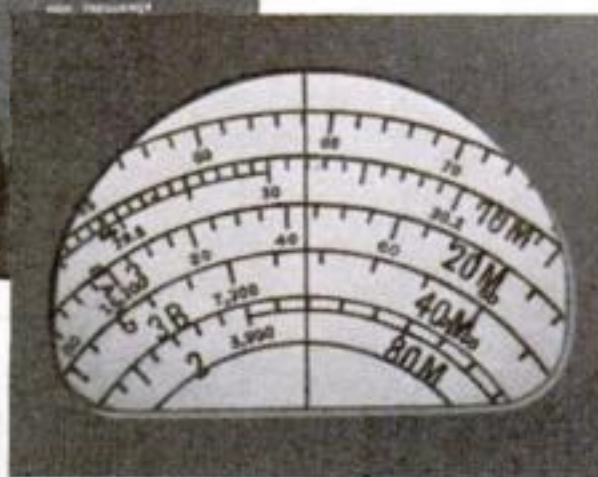
All-Wave Set Has Band-Spread Dial

DESIGNED so that tuning "drift" during the warming-up period is reduced to nearly zero, the tuning mechanism of a new communications receiver that covers a range from 540 kilocycles to 43.2 megacycles also offers a novel

electrical band-spread dial. After setting the main tuning dial on a short-wave band, say at 14.4 megacycles, an auxiliary band-spread dial gives the exact frequency reading between 14.1 and 14.4 megacycles, in divisions of 5 kilocycles, through a 200° arc.



After setting the main dial of this all-wave set, a band-spread dial (inset) shows exact frequency readings



Opening door disconnects batteries

Three-Way Portable Receiver

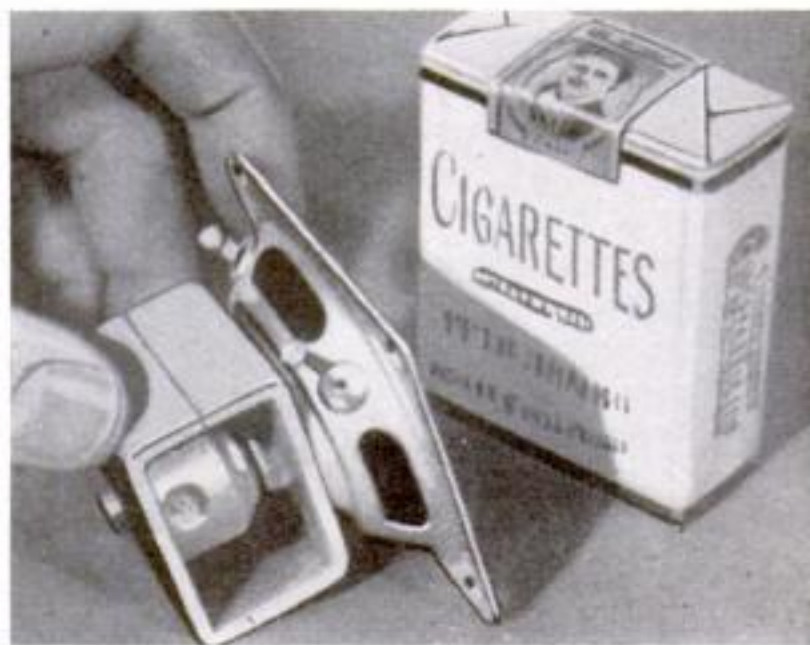
A COMPACT "three-way" portable receiver just announced is designed to operate on either alternating or direct house current, or on its own self-contained batteries. When a small door in the side is opened and the power cord removed, all batteries are automatically disconnected from the circuit.

Glass Cores and Coverings Make Resistors Flexible

FLEXIBLE resistors with cores and braided coverings of glass thread are now available for amateur set builders. They may be crammed into small spaces without damage, the makers state. In addition, the glass permits them to operate at high wattages and temperatures up to 1,000 degrees F., without harm.



This flexible resistor is available in various sizes with all conventional tips



Tiny New Loudspeaker

SCARCELY as large as a package of cigarettes, the diminutive permanent-magnet speaker shown above has a full-floating cone only 2" in diameter and capable of high output and frequency response. With a special transformer, it becomes a dynamic microphone.

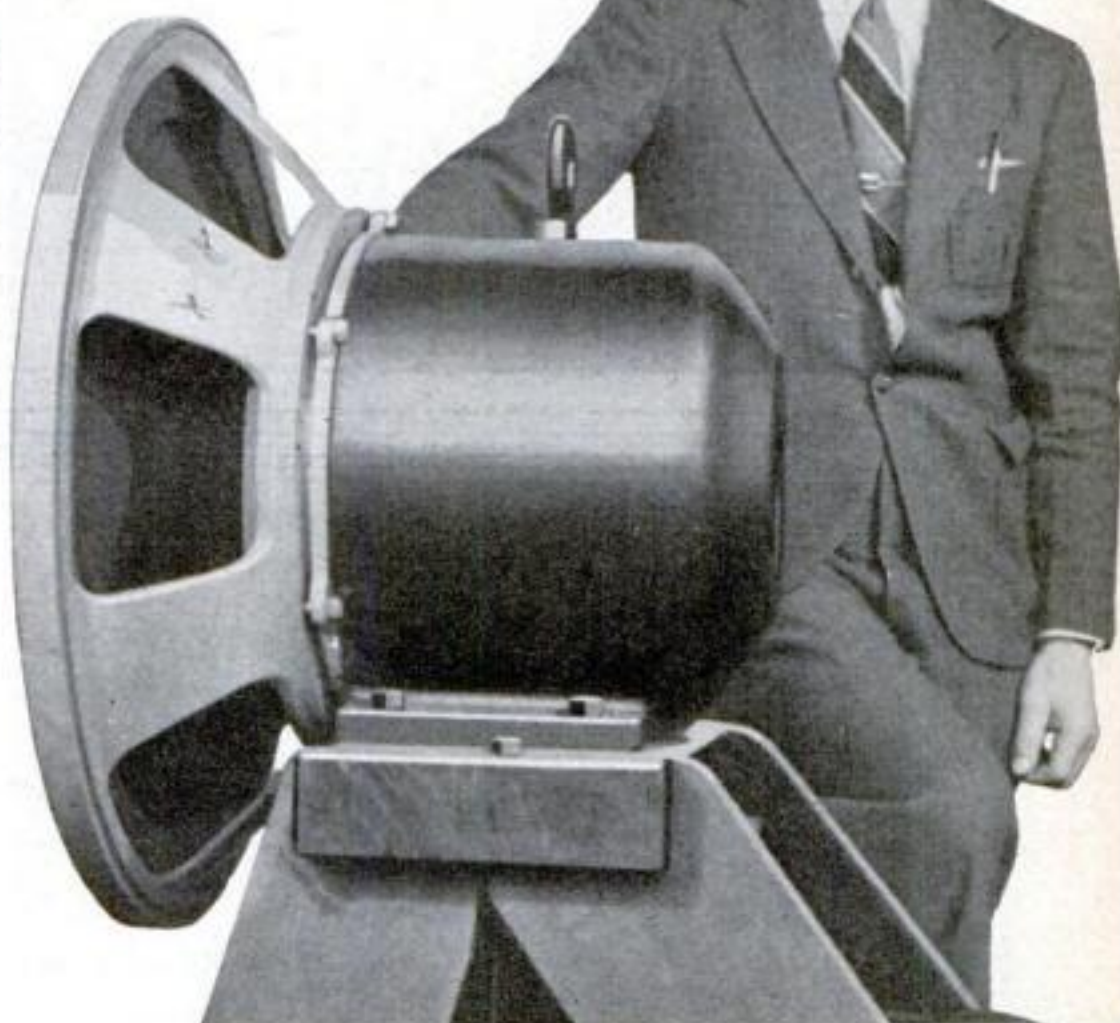
RADIO FAN



The voice coil, left, of the 500-pound speaker is 6" in diameter; the cone is 27"

Speaker Weighs 500 Pounds

THE largest electrodynamic loudspeaker ever placed on the market has just been offered by an eastern manufacturer for use in sound-reproduction systems which involve unusually high power. The cone, made of special paper of graduated resilience, is more than 2' in diameter. It is attached to a voice coil 6" in diameter that is wound on a microscopically thin form made of a special alloy.



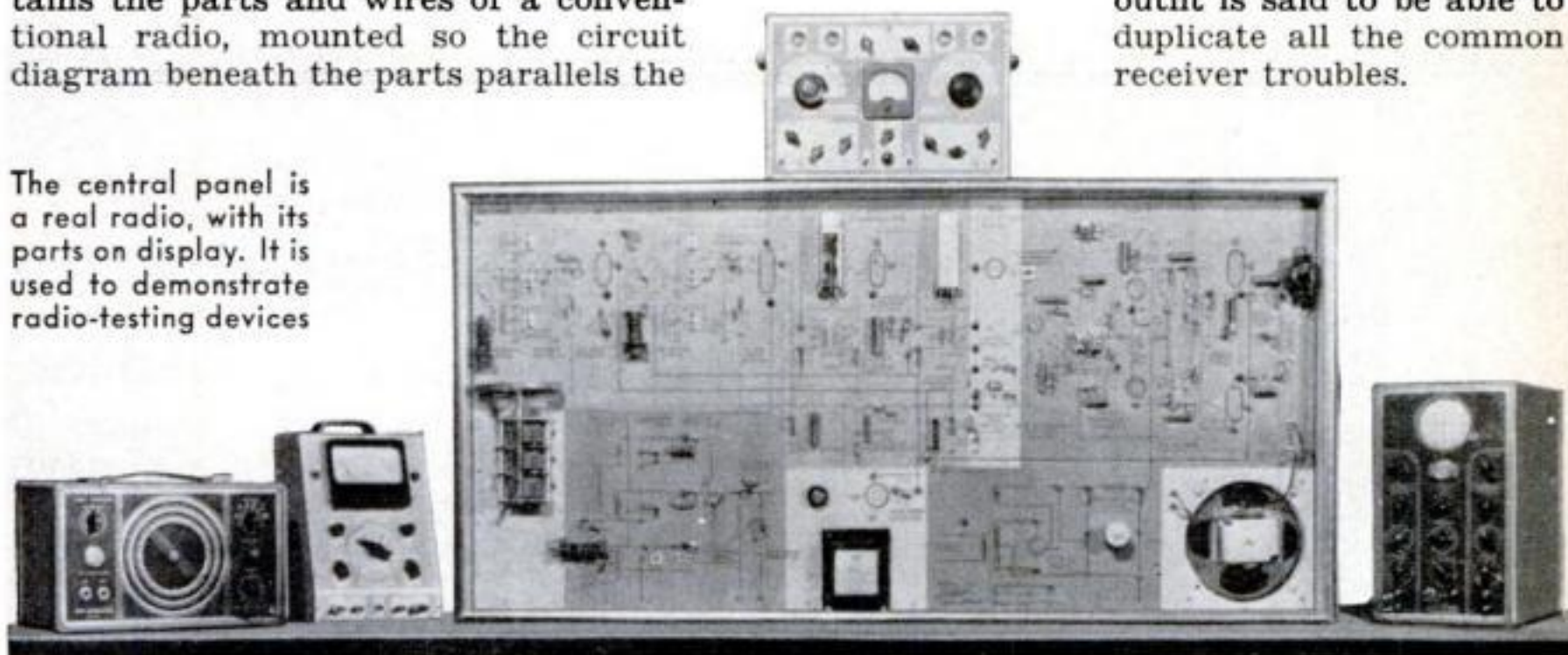
Using a special magnet iron, the 500-pound unit can handle an output that would require the full power of up to fifteen conventional-size speakers.

Novel Display Shows Radio Troubles

CAPABLE of creating and then spotting any trouble to which radio receivers are subject, the novel set-up illustrated below is designed to demonstrate the efficiency of trouble-locating apparatus. The large panel contains the parts and wires of a conventional radio, mounted so the circuit diagram beneath the parts parallels the

hook-up at every point. Convenient switches "create" the radio troubles which the trouble-shooting equipment, arranged around the main panel in the photograph, quickly identifies and analyzes. The outfit is said to be able to duplicate all the common receiver troubles.

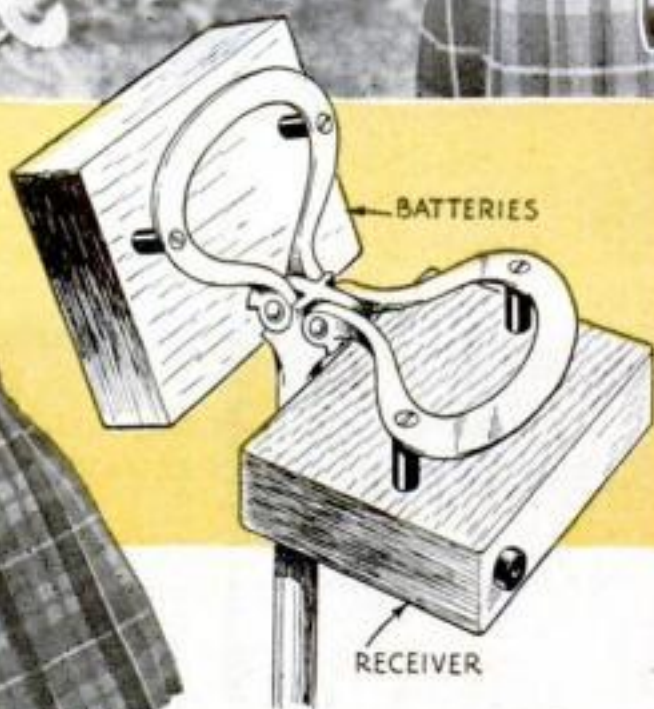
The central panel is a real radio, with its parts on display. It is used to demonstrate radio-testing devices



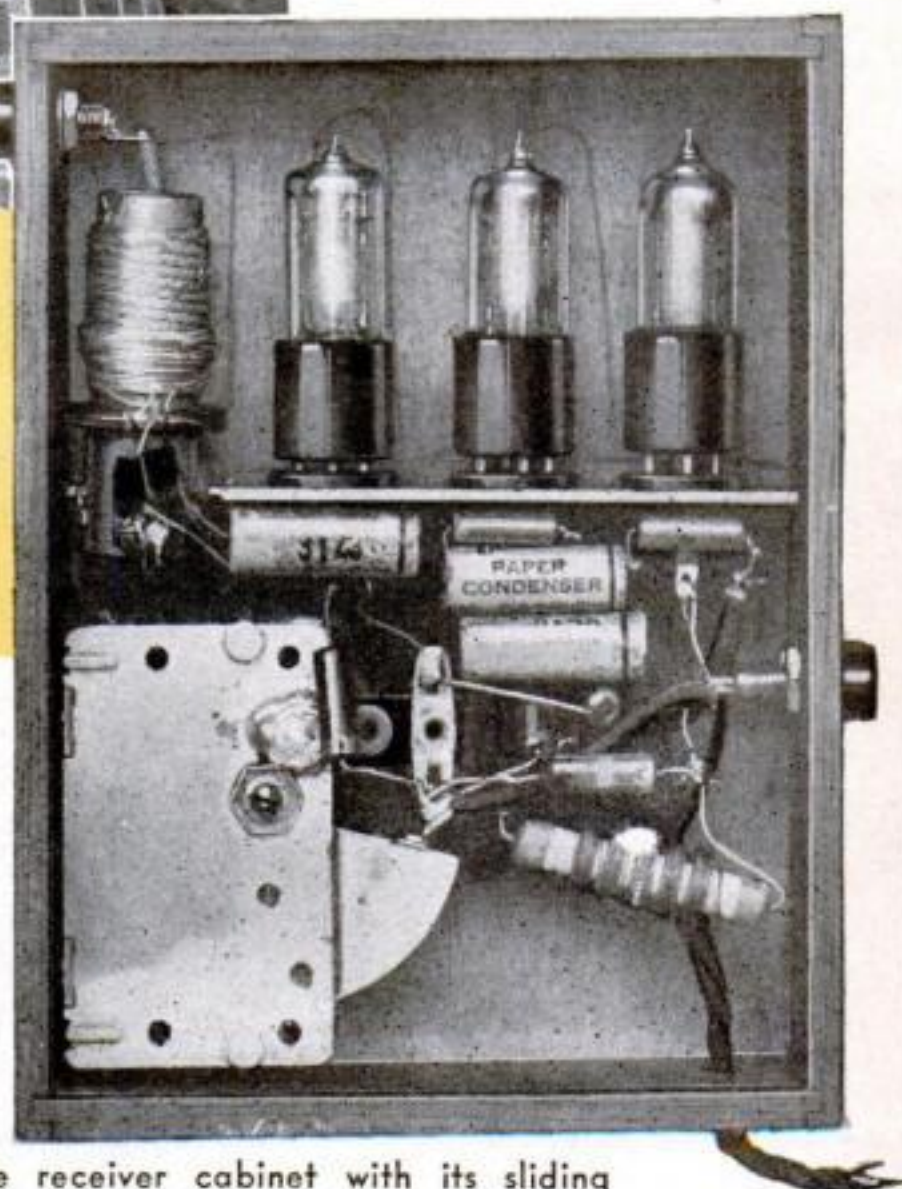
SPORTS RADIO Is

CONSISTING of a compact yet powerful battery receiver mounted on a conventional cane-seat which can be purchased for a dollar or two, the radio illustrated forms a handy set for hikers, sports spectators, and campers. The circuit, designed around three of the new American-made midget tubes, consists of a pentode regenerative detector, resistance coupled to a pentode amplifier which in turn is resistance coupled to a second audio-amplifier stage. Regeneration is controlled by a 25,000-ohm potentiometer. Since the commercial type of antenna coil shown in the diagram has no tickler

By
FRANK TOBIN



Cabinets mounted on the handles of the cane-seat house the set and batteries



The receiver cabinet with its sliding cover removed to show the three small tubes, tuning condenser, and chassis

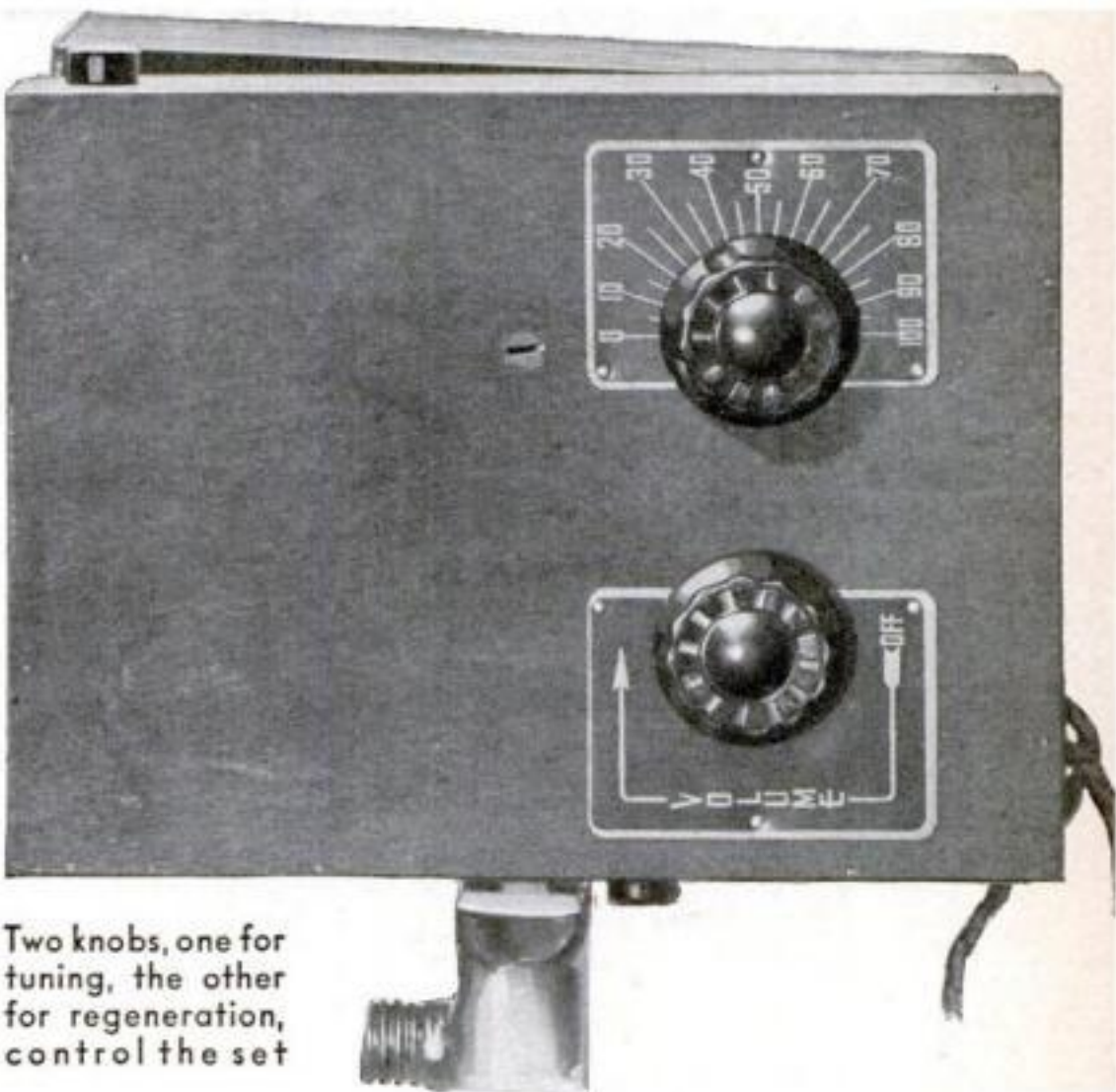
Combination Cane and Seat

winding it will be necessary to provide one by winding approximately thirty-five turns of No. 38 double-silk-covered wire around the lower end of the long, flat grid coil.

With the maximum of 45 volts of "B" voltage used, $\frac{1}{2}$ watt, or even $\frac{1}{4}$ watt, resistors can be used, while a maximum rating of 200 volts is sufficient for the .01 mfd. by-pass and coupling condensers. These condensers can be of the paper or tubular type. All other condensers, however, should be of the mica variety.

The receiver and its battery supply are housed in two cabinets each $1\frac{5}{8}$ " by $4\frac{1}{4}$ " by $5\frac{1}{2}$ " and mounted on the handles of the cane. Sliding panels serve as covers and make it an easy matter to change batteries or make repairs. The cabinets are fastened to the aluminum handles by means of long bolts and metal bushings.

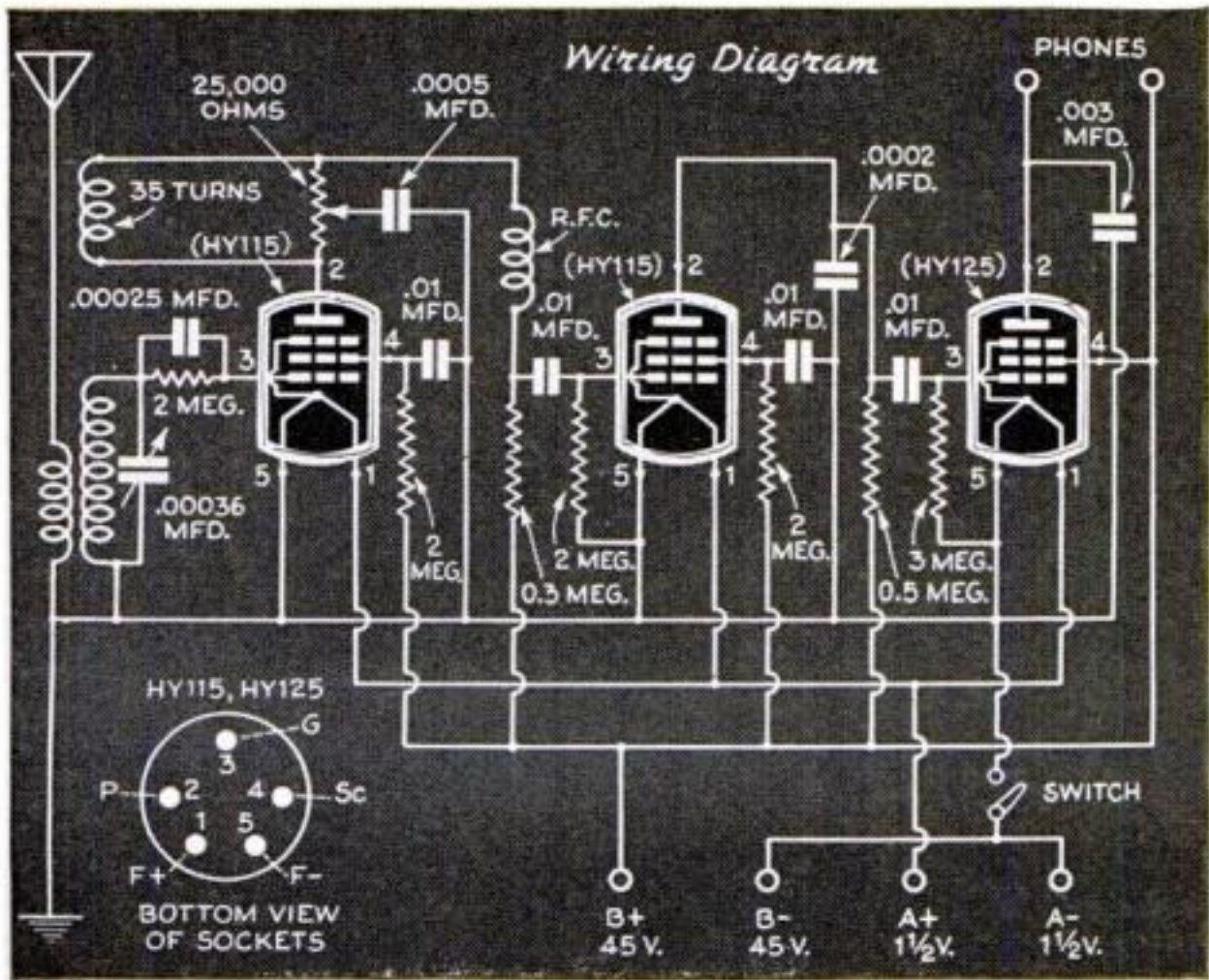
Two $1\frac{1}{2}$ -volt cells connected in parallel serve as the "A" battery supply, and may be obtained as a single unit or by breaking open a four-cell "A" battery. The midget



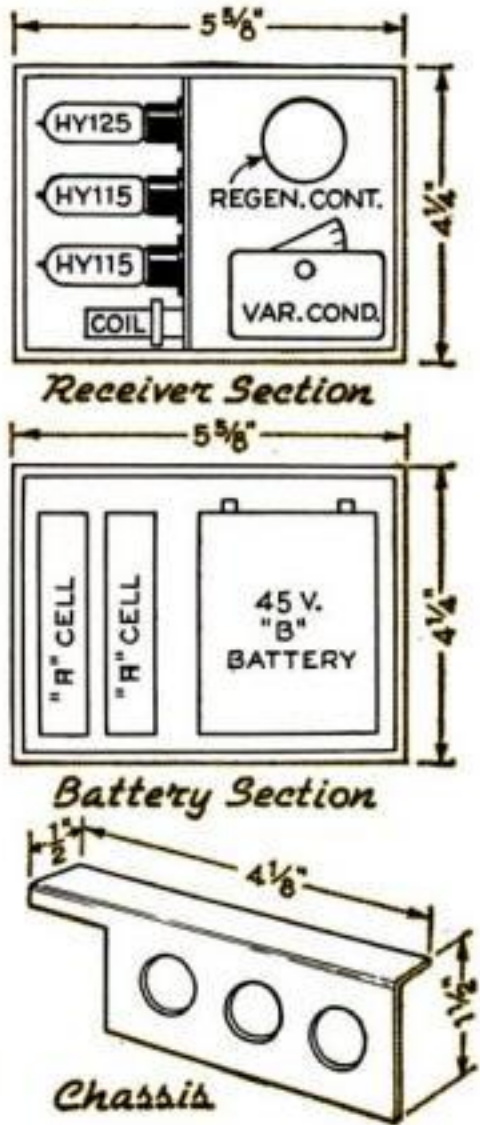
Two knobs, one for tuning, the other for regeneration, control the set

45-volt "B" battery fits snugly beside the "A" cells in the battery cabinet.

For an antenna, a steel fence, the metal cane, or a 35' piece of wire will serve.



How the circuit should be wired and cabinets and chassis constructed

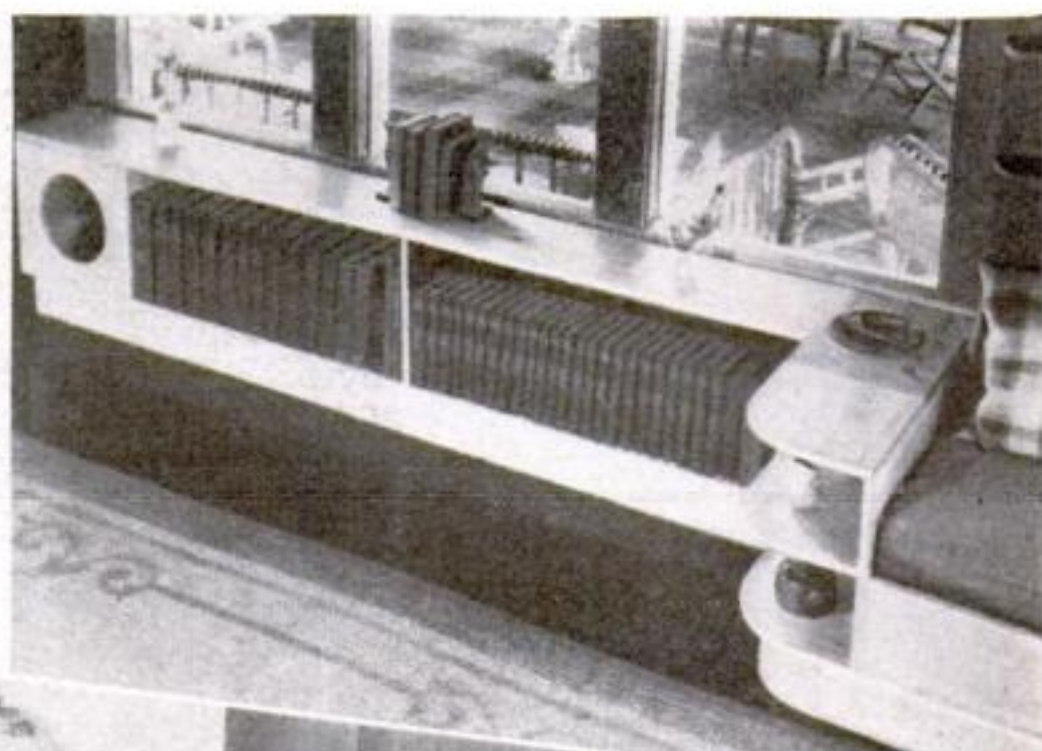




Built to match the walls, one cabinet holds the phonograph and radio, the other the loudspeaker

Cabinet Ideas for Radio Builders

WITH unmounted radio chassis, home owners handy with tools can build cabinets to harmonize with the decorative scheme of a particular room. Four suggestions are shown in the photographs on this page. At the top, twin cabinets were built of knotty pine, one housing the radio and phonograph and the other the loudspeaker. Other schemes pictured are a unit built into the end of a divan, a modernistic cabinet separating a living room and foyer, and a cabinet for an entrance hall.



Here are three other methods of adapting the radio to the architectural and decorative scheme of an individual room

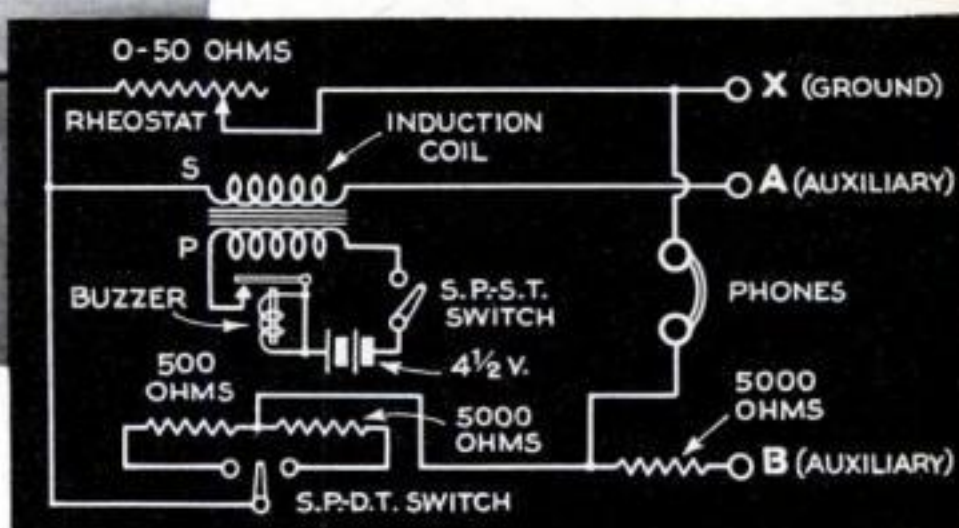




The author using the test circuit shown at the left to measure a small resistor

Pocket-Size Radio Tester

IS EASY TO BUILD
FROM ODDS AND ENDS



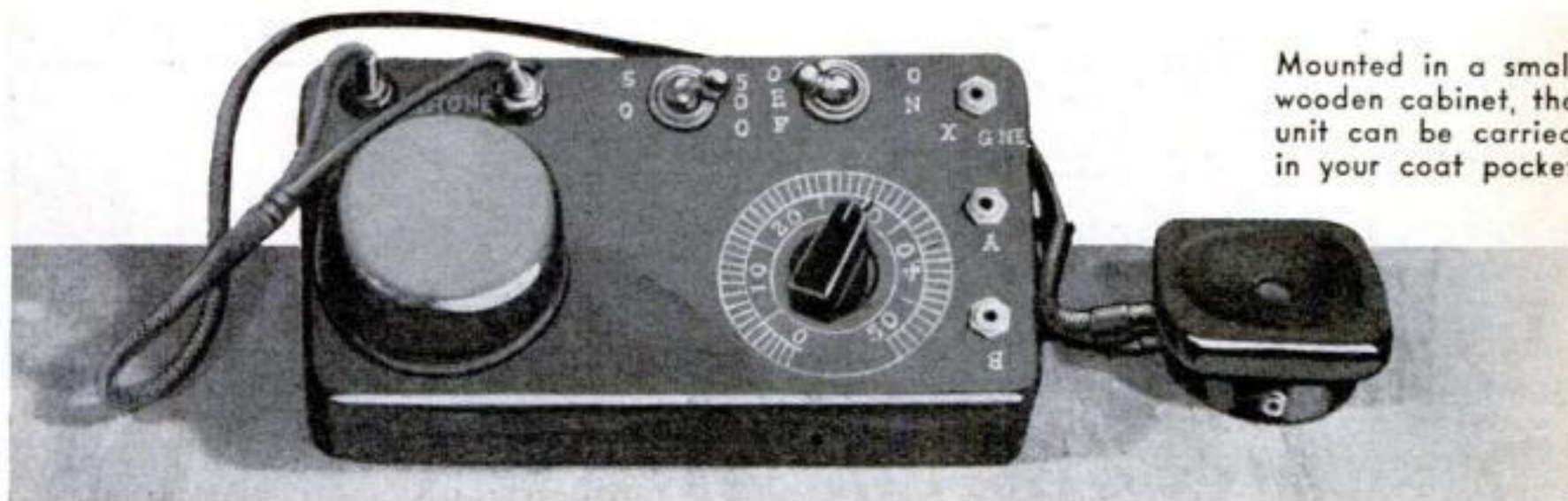
PROVIDING a quick and easy means for measuring small resistances and testing grounds, the unit illustrated forms a handy piece of equipment for the radio experimenter and service man.

The circuit consists of a buzzer and battery, three fixed resistors, a rheostat, an induction coil, two switches, and an earphone. As shown in the diagram, three binding-post terminals (A, B, and X) are provided. To test a resistance up to 50 ohms, terminals A and B are connected together with a short piece of wire, the toggle switch is flipped to the "50" position, and the unknown resistor is connected across terminals X and A. The buzzer is then turned on and the rheostat adjusted until the buzz *cannot* be heard in the earphone. The position of the pointer on the rheostat scale indicates the value of the resistor. For resistors from 50 to 500 ohms, the toggle switch is moved to the "500" position and the same procedure followed, but the scale reading must be multiplied by ten.

In testing grounds, simply connect the ground in question to terminal X, attach terminal A to some other ground, and terminal B to a third ground, which can be nothing more than a screw driver pushed into the earth. When the rheostat has been adjusted to eliminate the buzz, the resistance of the ground can be read directly from the rheostat scale.—E. J. HOBERT.

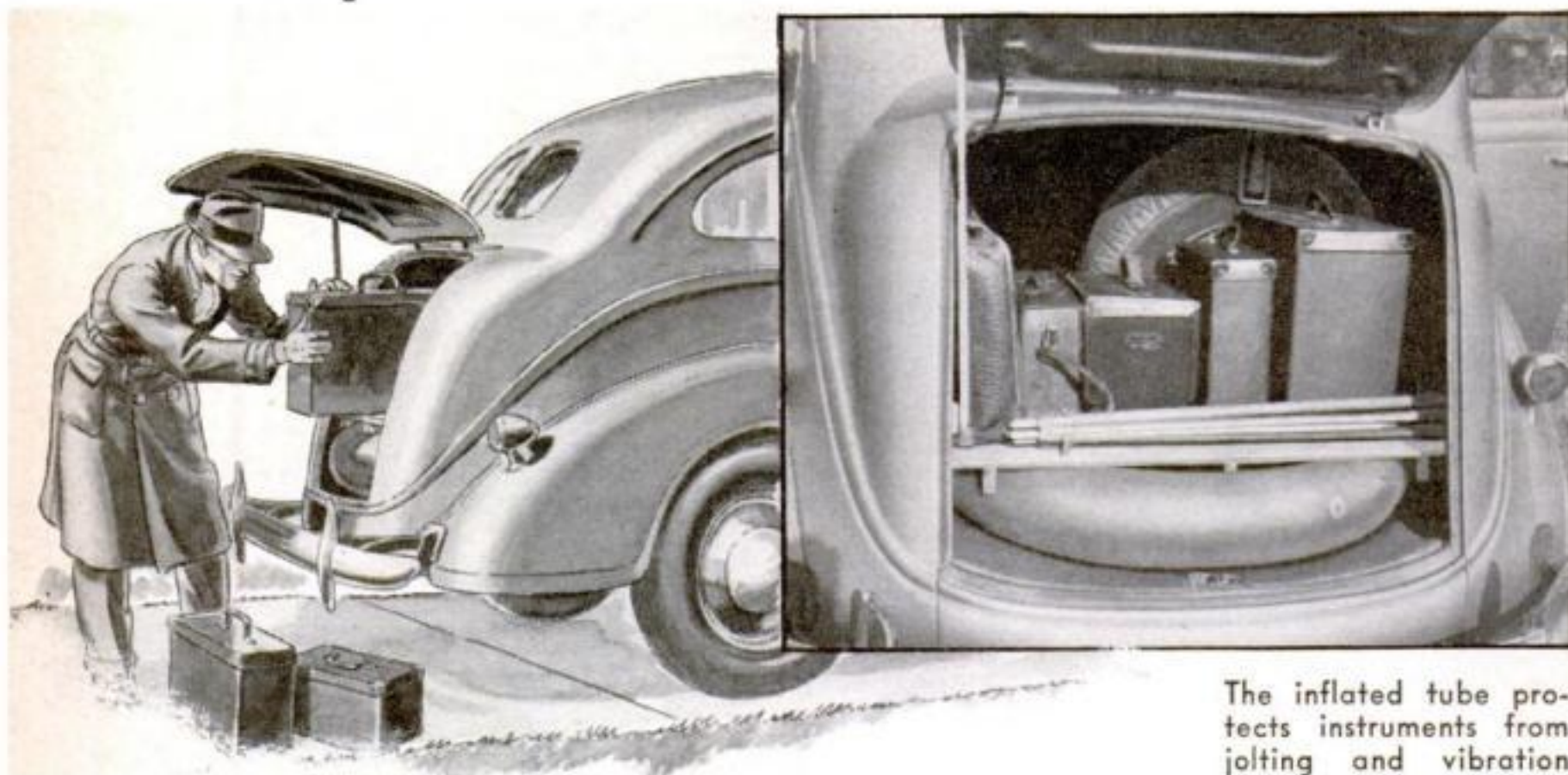
LIST OF PARTS

Fixed resistor, 500 ohms.
Fixed resistors, two 5,000 ohms.
Rheostat, 0-50 ohms.
Single-pole, single-throw switch.
Single-pole, double-throw switch.
High-frequency buzzer.
Induction coil, 1-100 ratio.
Battery, 4½ volts.
Binding-post terminals, three.



Mounted in a small wooden cabinet, the unit can be carried in your coat pocket

Helps for the Motorist

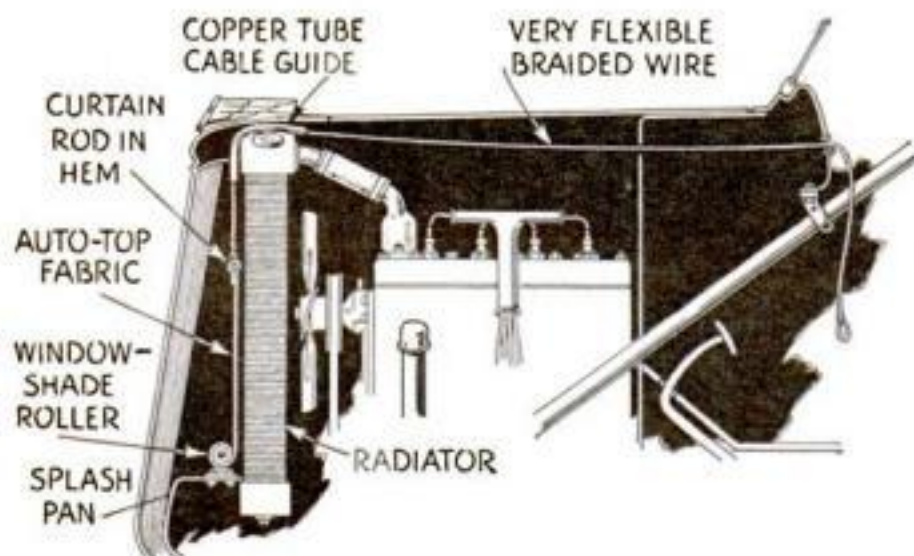


The inflated tube protects instruments from jolting and vibration

Inner Tube Cushions Delicate Luggage

FRAGILE luggage such as cameras, surveying instruments, and other equipment that might be damaged in the trunk compartment of an automobile by the vibration of the car traveling over rough roads, can be protected against breakage by pil-

ing it on a light wooden platform resting on an old inner tube placed on the compartment floor. Adjust the inner tube's air pressure to the weight of the equipment, and vibration will be absorbed. When not in use, the tube can be deflated.—O. L. S.



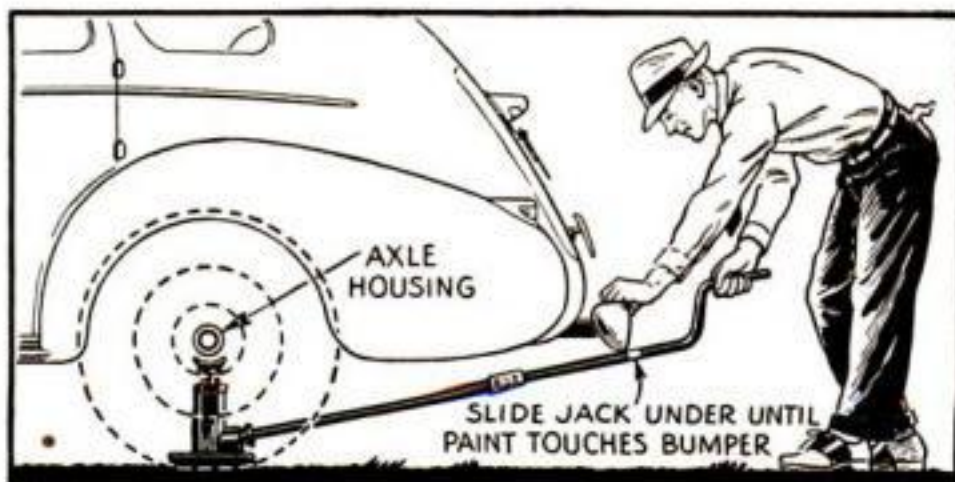
How screen is installed behind the radiator grille

Roller Radiator Screen Controlled from Dash

TO GET quicker warm-up in cold weather, I outfitted my car with a homemade device to control engine temperature. An ordinary window-shade roller was installed behind the radiator grille and in front of the radiator itself. To this I attached a strip of auto-top fabric so that it could be wound and unwound by means of a cable leading to the dashboard, as pictured at the left, thus controlling the flow of air.—H. S.

Mark on Handle Shows Position for Jack

PLACING a jack directly under the rear-axle housing of a car is made easy by the simple expedient of painting a narrow ring around the long jack handle at the exact spot where it meets the rear bumper when the jack is in the correct position, as illustrated.—W. C. W.



This stunt makes it easy to place the jack under the axle

*...and you've
got to be
good to tell
them apart*

OUTDOORS
IN THE SUN



INDOORS
AFTER DARK

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Kodak Super-XX Film**



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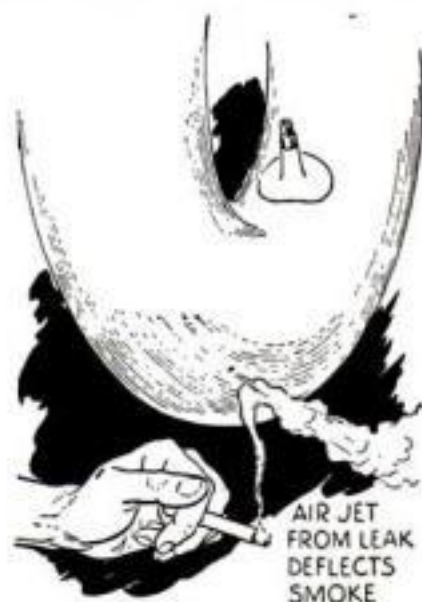


Microscopists' Cement Hides Windshield Cracks

CRACKS and chipped-out places in automobile windshields can be repaired and sometimes rendered invisible with Canada balsam, obtainable at most drug stores and from dealers in microscope supplies. Apply the balsam to the damaged spot, and work it in with a toothpick if necessary. Let it pile up around the spot a little and after it has hardened, a process that make take several days, smooth it to the level of the glass with a razor blade. Balsam has about the same index of refraction as glass, and therefore makes practically invisible any hole or crack in glass that it fills. The material may be thinned, if required, with xylol, turpentine, lacquer thinner, or other solvent, and for best results should be applied on a warm day.—W. E. B.

Cigarette Smoke Finds Leak in Inner Tube

A BURNING cigarette can guide you in locating a leak in an inner tube, in case it is not convenient to dip the tube into a tub of water. The cigarette is moved around the surface of the inflated tube, until the air jet from the leak deflects the rising smoke. Make sure, before using this method, that there are no strong air currents in the room where it is being done.—R. B.





SAW FILING

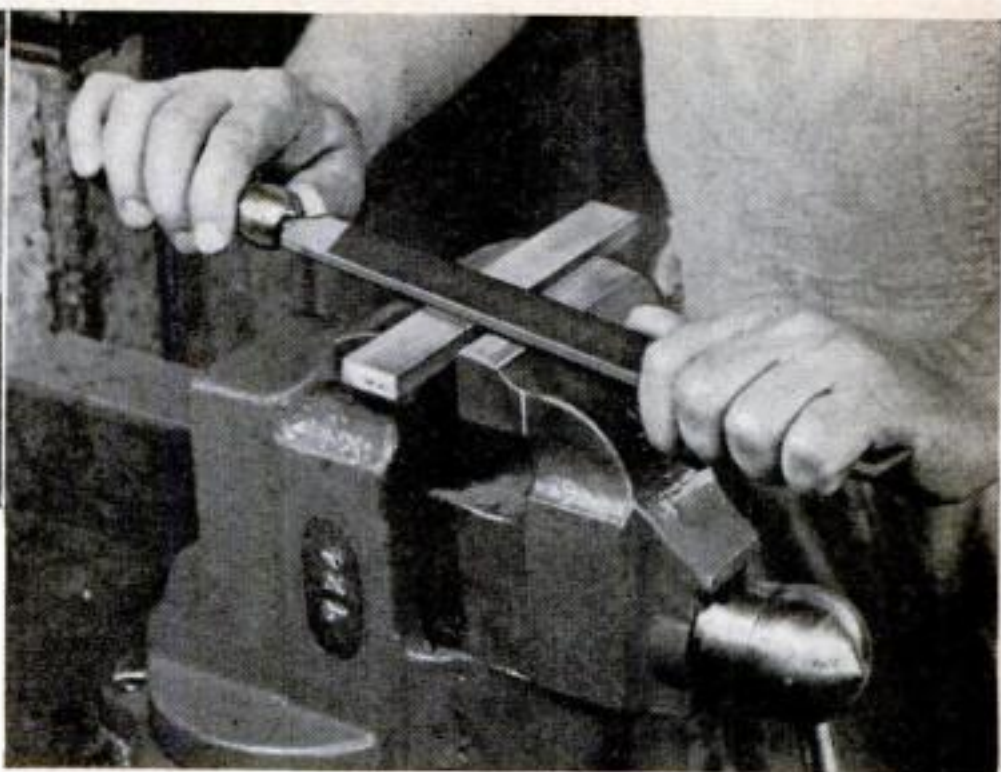
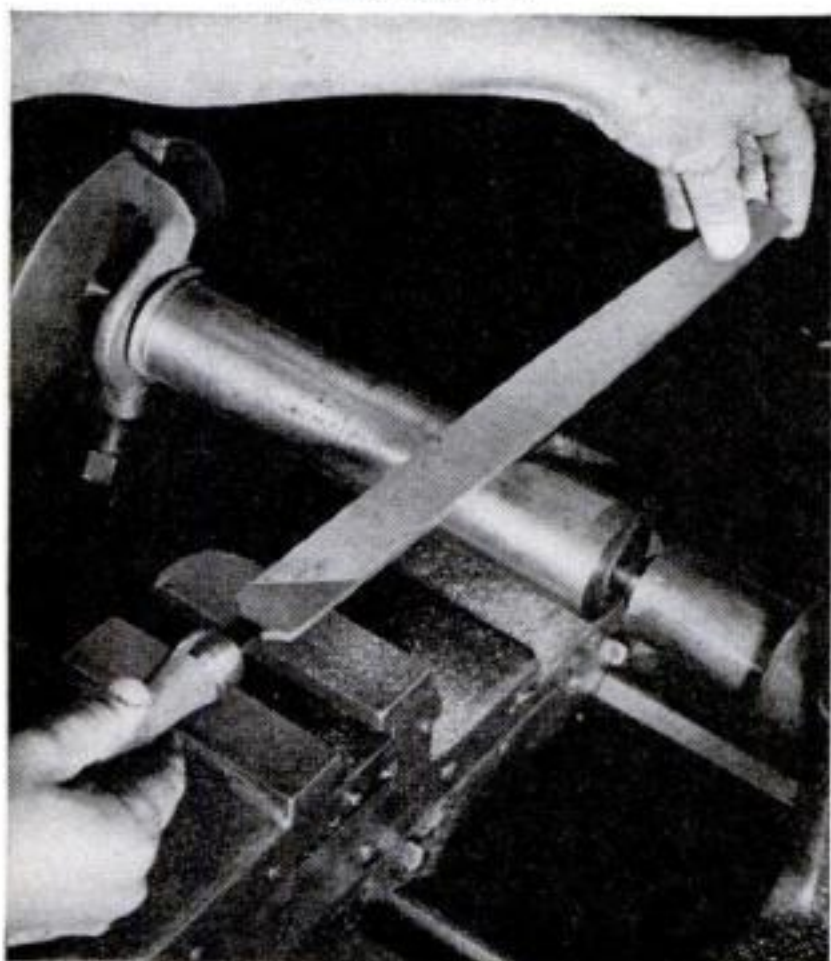
IT'S AN ART!

The right file in hands that know how to give it "just the right touch" is often the deciding factor between the success and failure of a working model or experimental job representing hours, days or weeks of patient development.

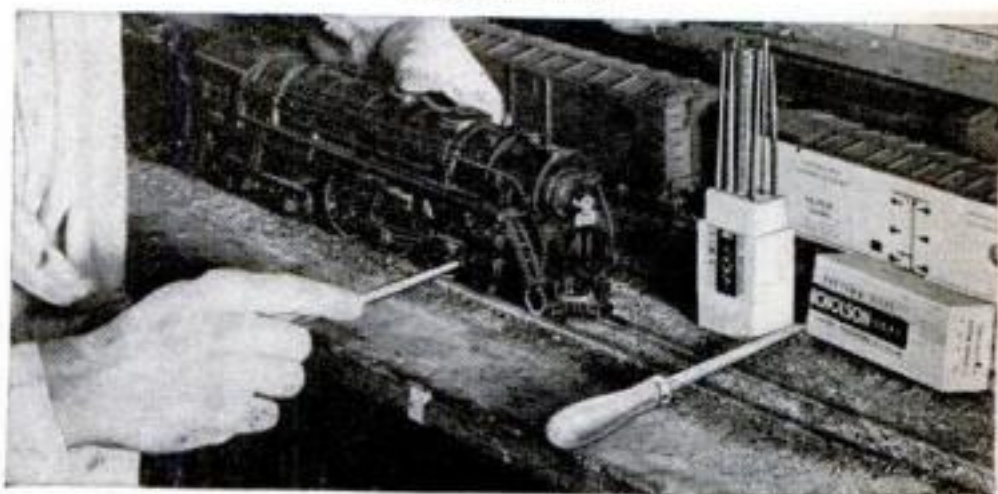
Yes, filing is an art. Never use the wrong type of file for the job — especially if it's a piece of precision work. With a popular range of Nicholson (or Black Diamond) Files on hand, each file lasts longer, does better work, costs less in the long run. They're easy to obtain — good hardware stores have them or can get them for you.

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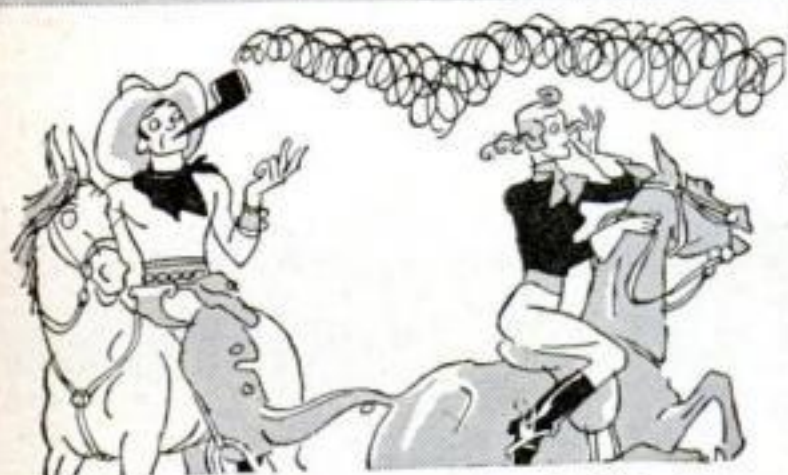
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"GIDDYAP, NAPOLEON! Looks like this Romeo is trying his darndest to smoke us out. Phew! His tobacco smells like the backfire from Pa's flivver!" Just then



UP RIDES A RANGER, sniffs the pipe, says to clean it and refill with *mild* Sir Walter, a burley blend famous for aroma. It worked! Joe won her back!

New! CELLOPHANE TAPE

around lid seals flavor in . . . brings you tobacco 100% factory-fresh!



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Rubber Strap Simplifies Removing Headlamp Rim



LOOSENING and removal of lens rims from headlights on cars several years old is simplified considerably if a tongue strap cut from an old inner tube is employed in the manner shown in the sketch above. The strap is stretched around the lens rim and the tongue slipped through the slit to hold it firm while the lens is being removed from the lamp.—G. E. H.

Compass Test Reveals Cracked Battery Wall

WHEN you are having starter or battery trouble in your car, it's a good thing to remember that a sudden jar, such as a battery would receive if accidentally dopped when being installed, will frequently crack the separator between two cells. The outside of the battery case will not reveal this but you can determine the fact easily with the aid of a compass. Place it on the lead strap connecting first one set of cells and then the other. If a separator is cracked, the compass needle will be deflected at right angles to the connecting strap between the cells. If you do not get this reaction, you must look for the trouble elsewhere.—E. J. N.



Ask Your Dealer to Show You These *Atlas* Features

See what Atlas engineers have done for you in developing the new F-Series 10" Lathe. Then you'll know why experienced machinists everywhere are advising—"Get a modern Atlas." You'll discover it is the only lathe that gives you precision and performance at a sensible price, because it is modern in design and efficiently engineered. Whatever the job, these are some of the Atlas features that will help you do it easier and better:

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- **Custom-Bored Spindle Bearings** positively aligned by boring *after the headstock has been fitted to the bed.*
- **Backgeared Power**—Complete V-Belt Drive—Wide Screw-Cutting Range—Quick-Change Countershafts—Rugged Zamak Alloy Parts—at no extra cost.
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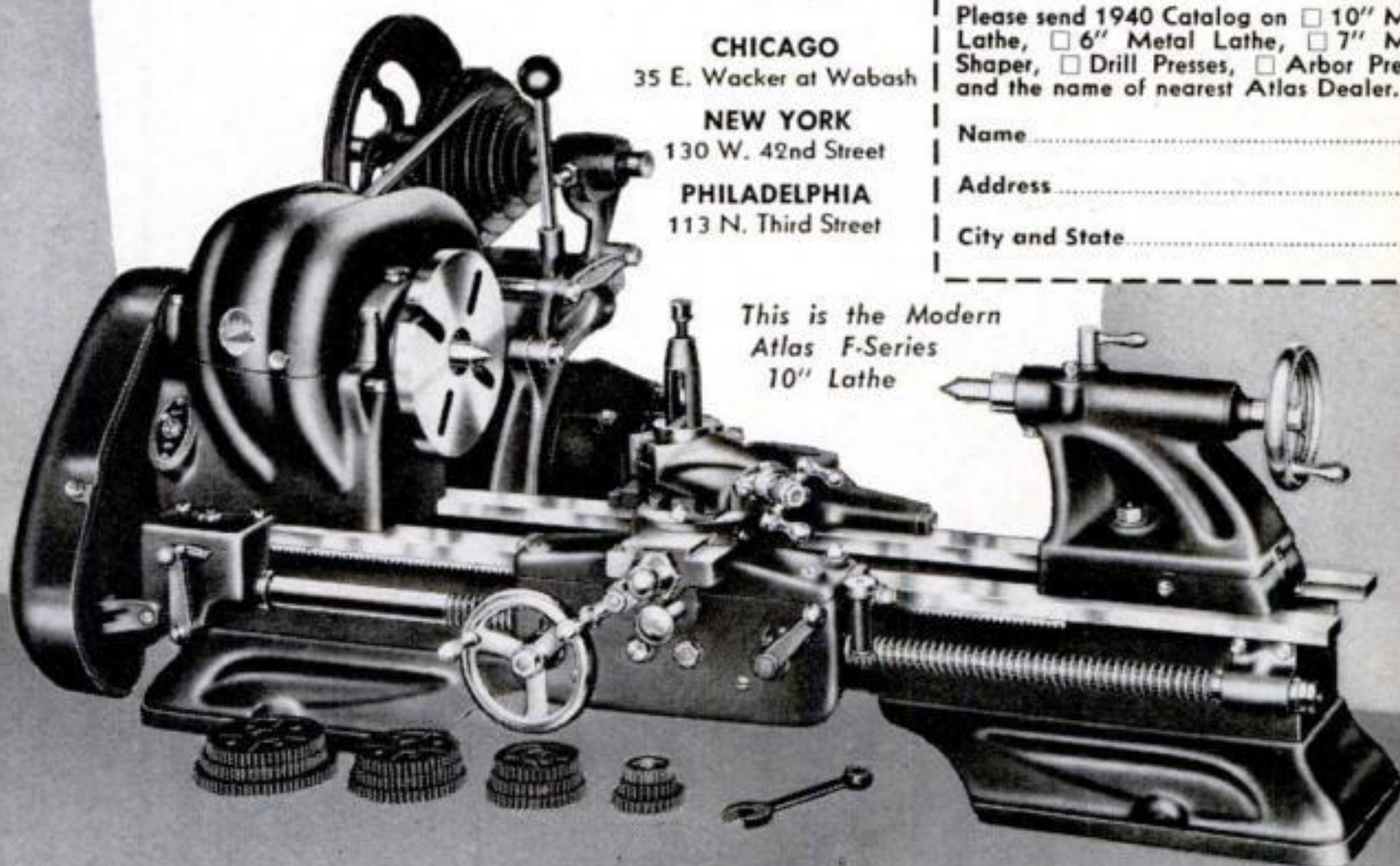
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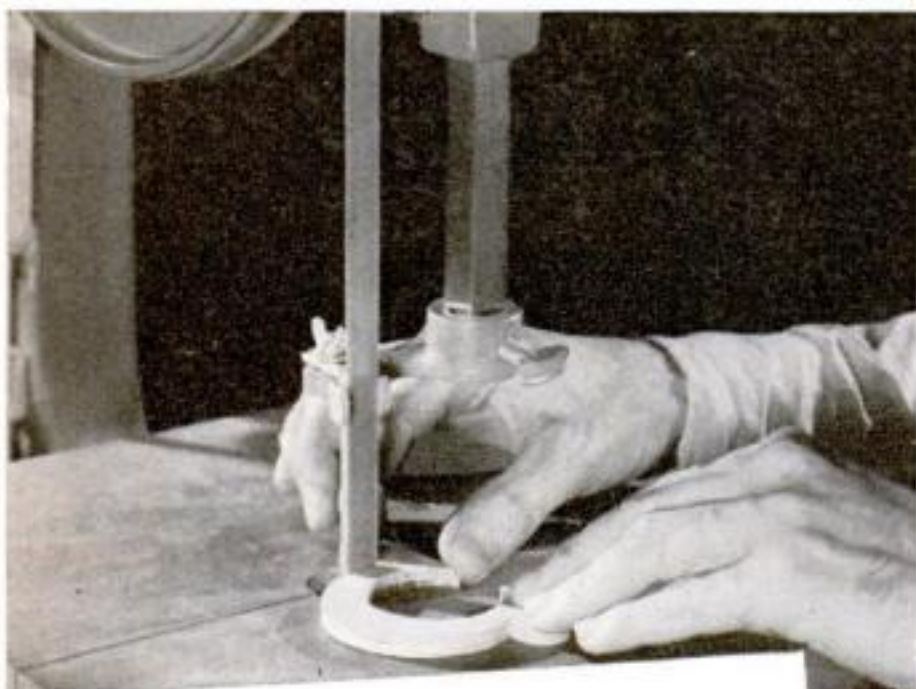
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How to smooth the edges of delicate scrollwork

● Here's another shortcut with Electrocoated Aloxite Brand Aluminum Oxide "K-5" Abrasive Cloth. A long, narrow endless belt of this material can be joined at the ends and mounted on an ordinary bandsaw and used for a wide variety of delicate sanding operations, to very close tolerances.

This arrangement is particularly useful for sanding small pieces of wood, metal or other materials, and for smoothing the edges of scrollwork whose shapes permit them to be reached by the belt. Beveled cuts can be made by tilting the bandsaw table. Complete directions for converting your bandsaw are contained in the manual offered below.

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Niagara Falls, N. Y.

[Carborundum, Aloxite and "K-5" are registered trade-marks of The Carborundum Company]



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IF YOU intend to build our new round-bottom, family runabout, you will find that full-size patterns will make your work much easier. The set costs only \$1.50 and includes patterns of the molds, transom, and stem. Blueprints cost an additional \$1.00. If you wish both the prints and the patterns, the total cost is \$2.50. Blueprints are mailed at once, but there will be a delay of about ten days before you receive the patterns because they are drawn to order by the designer.

Blueprints for other boats and many kinds of furniture, radio sets, models, and novelties are also available. A few of them are listed below. A complete list will be sent upon receipt of a self-addressed, stamped envelope.



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Cabin Cruiser, 17' long, weighs 750 lb., for use with outboard or inboard drive, 356-357-358-359-R	\$1.50
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Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p., can also be rowed, 344-345-R	.75
High-Speed Boat for Small Outboard Motors, 7' 11" long, 257-R	.50
Midget Boat or Pram, 9' long, for oars, sail or outboard motor, 339-R	.50
Motorboat-Rowboat, 13' long, with decked hull, for use with outboard or inboard drives and oars, 147-R	.50
Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged, 321-322-323-R	1.00
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Skiff, 13' 9" long, 4' 7" beam, weight 225 lb., for 1 to 16 h.p. outboard motors; can be rowed, 363-R	.50
Sport Runabout, 9' 8" long, for small outboard motors, weighs 100 lb., 309-310-R	.75
Utility Rowboat, 13' long; can also be sailed or driven by outboard motor, 224-R	.50

(Continued on page 225)

Plans for the Workshop

(Continued from page 224)



MODELS

Brig MALEK ADHEL, 20" hull, frame-and-plank or solid-hull construction, 304-305-306-R.....	1.25
Clipper Ship in a Bottle, 121-122.....	.50
Clipper Ship SOVEREIGN OF THE SEAS, 20 1/2" hull, 51-52-53-R.....	1.00
Cody Coach, 13" long, 144-145-146-R.....	1.00
CONSTITUTION ("Old Ironsides"), 21" hull, 57-58-59-R.....	1.00
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Spanish Treasure Galleon, 24" long, 46-47.....	.50
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U. S. Battleship TEXAS, 3' hull, 197-198-199-200.....	1.00
Viking Ship, 20 1/2" long, 61-62-R.....	.75

[Construction kits are available for some of these models. Turn to page 228]



FURNITURE

Colonial Writing Desk, 3' 6" high and 3' 8" long, 21.....	.25
Combination Bench and Tilt-Top Table, (no turning), 11.....	.25
Gate-Leg Table, 3' 6" diameter, circular top with leaves up (no turning), 24.....	.25
Low Stand, Early American Style; also Cactus Plant Holder and Metal Candle Stand, 361A.....	.25
Modernistic Stand (24 3/8" high) and Bookcase (70 1/2" high), 88.....	.25
Sewing Cabinet of 1812, 178A.....	.50
Small Early Colonial Pine Chest, 32" long, 21" deep, 24" high, 308A.....	.25
Tavern Table and Scroll Mirror, 105.....	.25
Telephone Table and Stool, 18.....	.25
Tilt-Top Table, 20" by 24" top, 249A.....	.25



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Amateur Short Wave Receiver, three tubes, battery or 110-volt A.C. or D.C. operation, 155.....	.25
Amplifier, Three Stage, 42.....	.25
Beginner's Battery Receiver, 365A.....	.25
Five Tube Short-Wave Set, midget receiver with loudspeaker, A.C. or D.C., 223.....	.25
One-Tube Receiver, battery operated, 103.....	.25
Screen Grid Receiver, 109.....	.25



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Bird and Animal Patterns, 56.....	.25
Electric Train, Horse, and Doll House, 14.....	.25
Indian Book Ends, Alligator Toy, and How to Cut Sheet-Metal Monograms, 360A.....	.25
Paddle-Wheel Magazine Rack, Ski Repairs, and Rack for Table-Tennis Paddles and Balls, 343A.....	.25
Perpetual Star Chart, 214.....	.25
Sandpaper Cabinet, Saw Horse, Tool Rack, Hand-Screw Rack, and Machinist's Hand Vise, 368A.....	.25
Six Simple Block Puzzles, 65.....	.25
Toy Lathe, Drill Press, Saw, and Jointer, 113.....	.25

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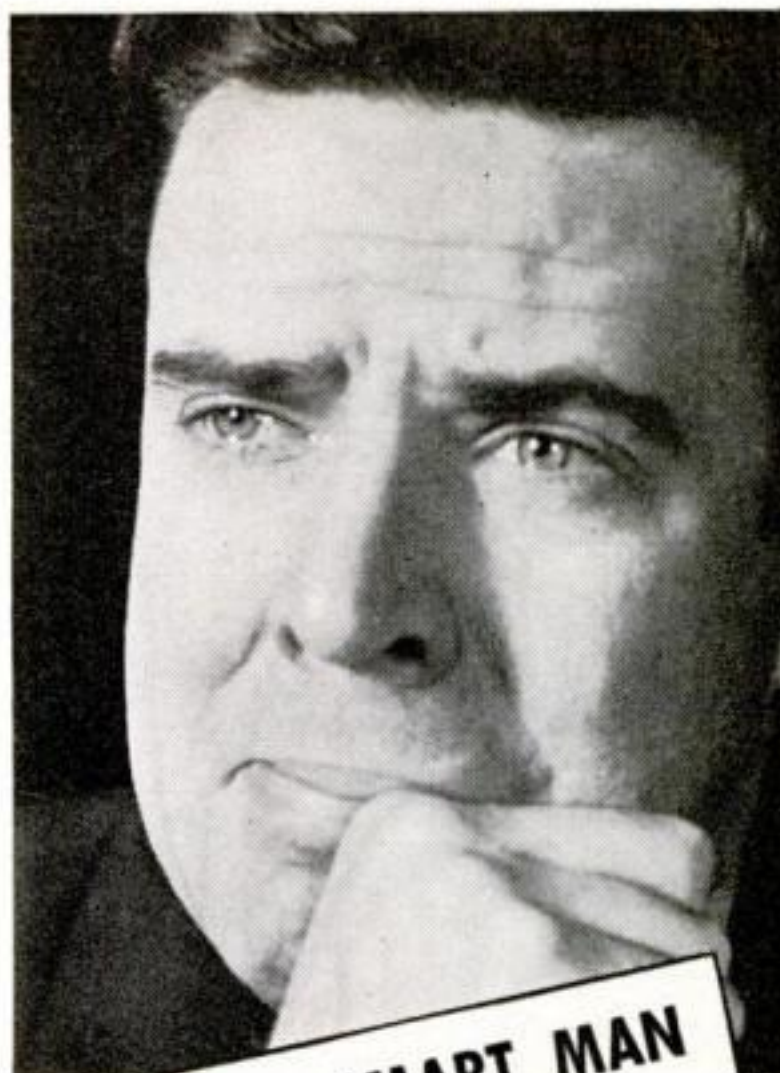
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Street.....

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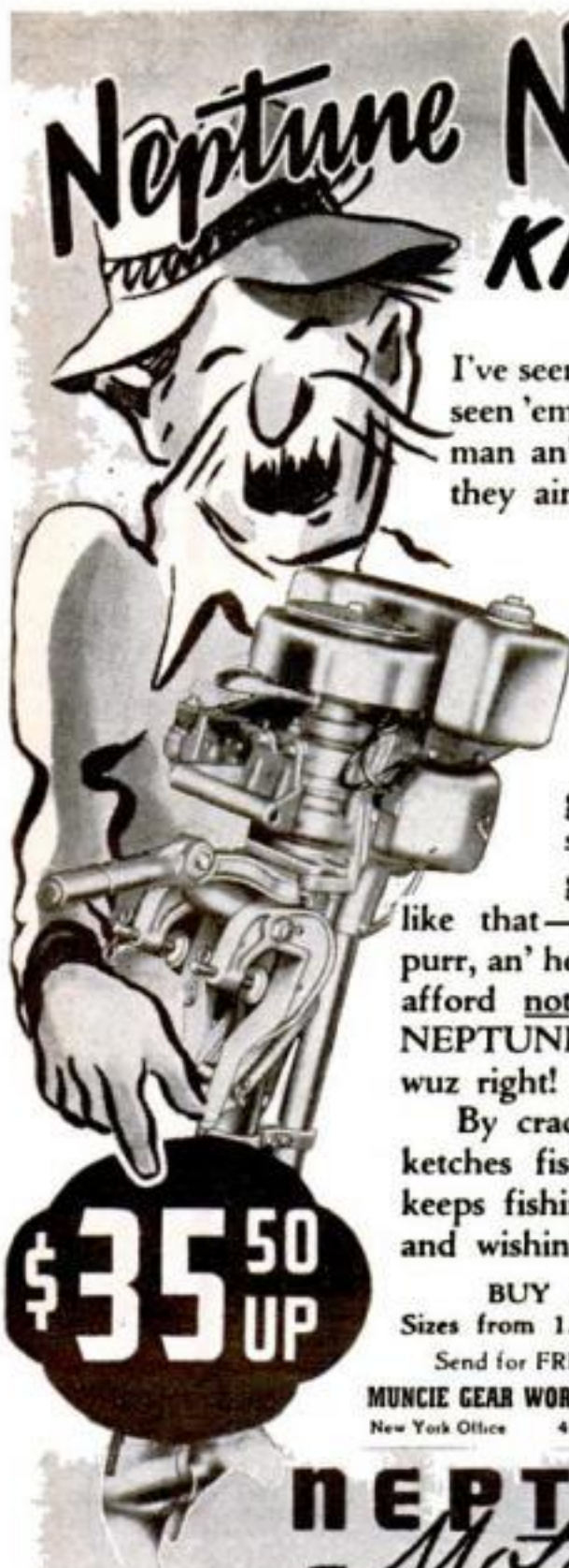
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Sez I to one of 'em, "I see ye got a motor there, son." He climbs in, gives 'er a flick—like that—an' she starts to purr, an' he yells back, "Cain't afford not to have one at NEPTUNE'S price." An' he wuz right!

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Ask for

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MANY operators don't get full life from a cut-off wheel because they use a conventional surface speed. If the wheel is safely guarded and has good spindle bearings, don't be afraid to step up the surface speed 25 percent over that used for a regular grinding wheel of identical diameter.

One piece of equipment that should never be shopmade is an acetylene generator. It might prove disastrous, and at best it is not likely to be any good.

The safest procedure in lapping a new set of split bronze bearings is to take them up gradually on the shaft or spindle while the latter is being power-operated at about 100 r.p.m. The lapping compound should be of a fine grade and mixed with water to a consistency that will flow to the bearings through the oil holes of the housing.

Don't forget that seamless steel tubing is not restricted to round stock. When you have the problem of machining a square or rectangular hole, it may be that tubing of the right shape and size will do the trick when welded in place.

When a cylindrical grinding machine is used for continuous production, many foremen now insist that it be run idle during the noon hour. The reason for this is that the change in bearing and lubricant temperature may otherwise spoil an expensive part demanding utmost precision.

Speaking of means to cut off stock, it's hard to tell how long the power hack saw and band saw will hold their own against the cut-off wheel and the acetylene torch for heavy work. The possibility of taking a 6" diameter slice with the wheel and ripping through $\frac{1}{8}$ " plates stacked 4" high with the torch is something to think about.

Any steel tool that removes metal is a metal-cutting tool, and that goes for files. Keep them clean for faster cutting and longer life.

New gears, regardless of design, are never completed until lapped into each other in the gear box. When a single replacement gear has to be made, it is good practice to make a cast-iron dummy to wear-lap the new part to match the old ones.

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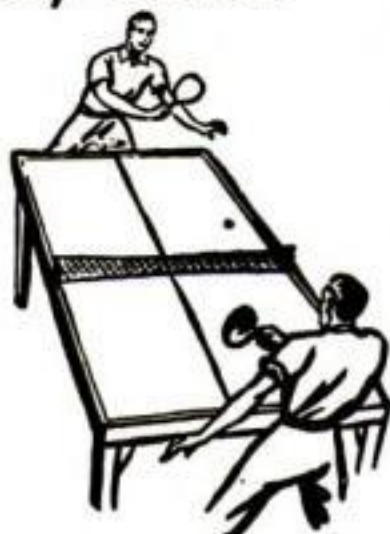


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● Apply coat of thin CASCO to wood table. Smooth out unbleached muslin onto wet glue and tack to edges of table. When dry, apply coat of thin CASCO and scrape it into cloth with paint scraper. Let dry, then sand lightly with 00 sandpaper and apply 2 coats of enamel.

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(Continued on page 230)

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Kits for Building Models

(Continued from page 228)



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MISCELLANEOUS

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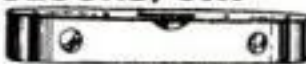
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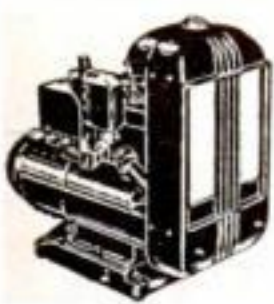
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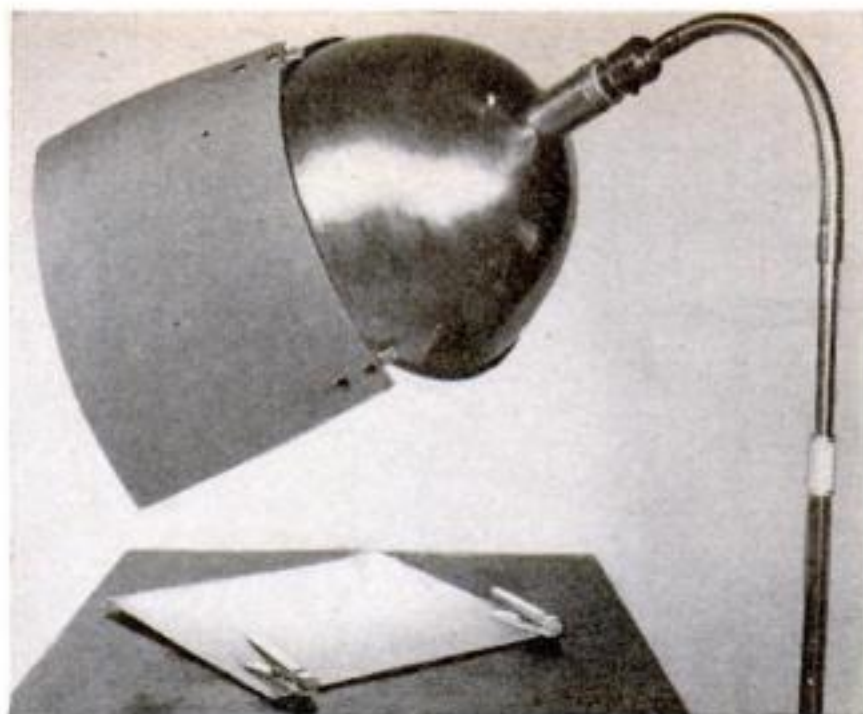


Photo-Lamp Reflectors Shielded with Cards

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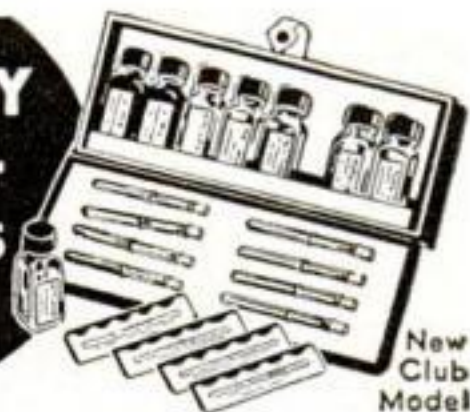
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Making of an Army Flyer

(Continued from page 123)

neck. He looked; the glass cockpit cover was streaked with rain. A heavy rumble crashed, a blinding flash showed heavy, massed clouds. The lights below were gone. No beacon, no stars—nothing but blackness. He turned the radio knob again. Not even the crackle of static could be heard; lightning must have put the set out of commission.

"It's an uncharted squall line," thought Rick, mindful of hangar tales of sudden storms that rose in the South and swept up out of uncharted Mexico.

A burst of wind flung the plane upward at a terrific rate. The altimeter fairly spun. Rick leaned forward on the stick. For a split second he had a horrible sensation that the elevator controls had broken loose, for the plane failed to respond. Then he noticed the gyro horizon. The white wings of the miniature airplane indicator had fallen far below the "level flight" lines. The ship must be nosed almost straight down, but he still was rising.

With a sudden rush, the up current ceased and Rick found himself abruptly in a power dive. He pulled out gradually at a slant that put him on the level prescribed for the flight. But the problem remained.

By rule, he should turn back and land at once. But where? A sudden squall like this probably would be of small extent. Five miles farther, the air might be perfectly clear. Probably most of the planes ahead had missed the storm entirely; so might those behind him. There'd be talk in the barracks if he should be the only pilot who didn't make it; quiet smiles—or worse, sympathy.

That was assuming, though, that he did not have to buck too much head wind, and that Kelly Field was clear and could be located without delay. On the other hand, Brownsville was nearer and the storm seemed to be moving northeast. Chances of clear weather were better behind him. He knew what the stage commander would think, what his instructors would say:

"Dead pilots aren't much good to the Army. You are flying a \$30,000 airplane and the Air Corps needs every one."

Rick set his gyro at zero, swung into a circle, made a 180° turn, and headed back. Sheet lightning flashed on his right, exposing heavy rolling clouds, black with rain. No lights in sight. The rain beat harder on the windshield, trickled dismally through the cracks between the sliding sections, onto his ankles. Again he consulted his map.

(Continued on page 237)

Making of an Army Flyer

(Continued from page 236)

Soon he should pick up a green marker beacon flashing two dots and a dash every fourteen seconds—emergency landing field. But there was only blackness ahead.

A burst of lightning showed a hole in the clouds. He put his rudder over, made a bee line for it, and dived. Another flash revealed three small buildings and a broad plowed field.

Rick made a wide circle and pulled the handle of the flare release. A tremendous burst of white light flared out. Crabbing right to offset the wind, Rick put the nose down into a regulation glide. He pushed a big lever below the dash, poked a button; heard the "clonk . . . clonk" of the retractable landing gear as its electrically driven mechanism swung it free from its anchorage and snapped the heavy carriage into place. At 200 feet he set the automatic landing flaps, and soon was settling heavily. Carefully keeping the nose out of a stall, he bumped to a jolting landing.

Rick shrugged out of his parachute harness and climbed out of the cockpit. He attached ropes to wing-tip lugs and the tail wheel; drove down steel anchor stakes, and stretched a canvas cover over the motor. As he finished securing the plane for the night, footsteps squished behind him.

"Army boy, eh? Are ye hurt?" It was a farmer, carrying a lantern. "Well, come on up to the house and we'll put you up in the spare room."

Half an hour later, Rick was sipping hot coffee and talking on the telephone with the Operations Office. "You're not the only one of the flight that met weather," he was told. "Four others set down at wayside fields, but you're the first to make a real emergency landing. Let us know if you need anybody to fly you out."

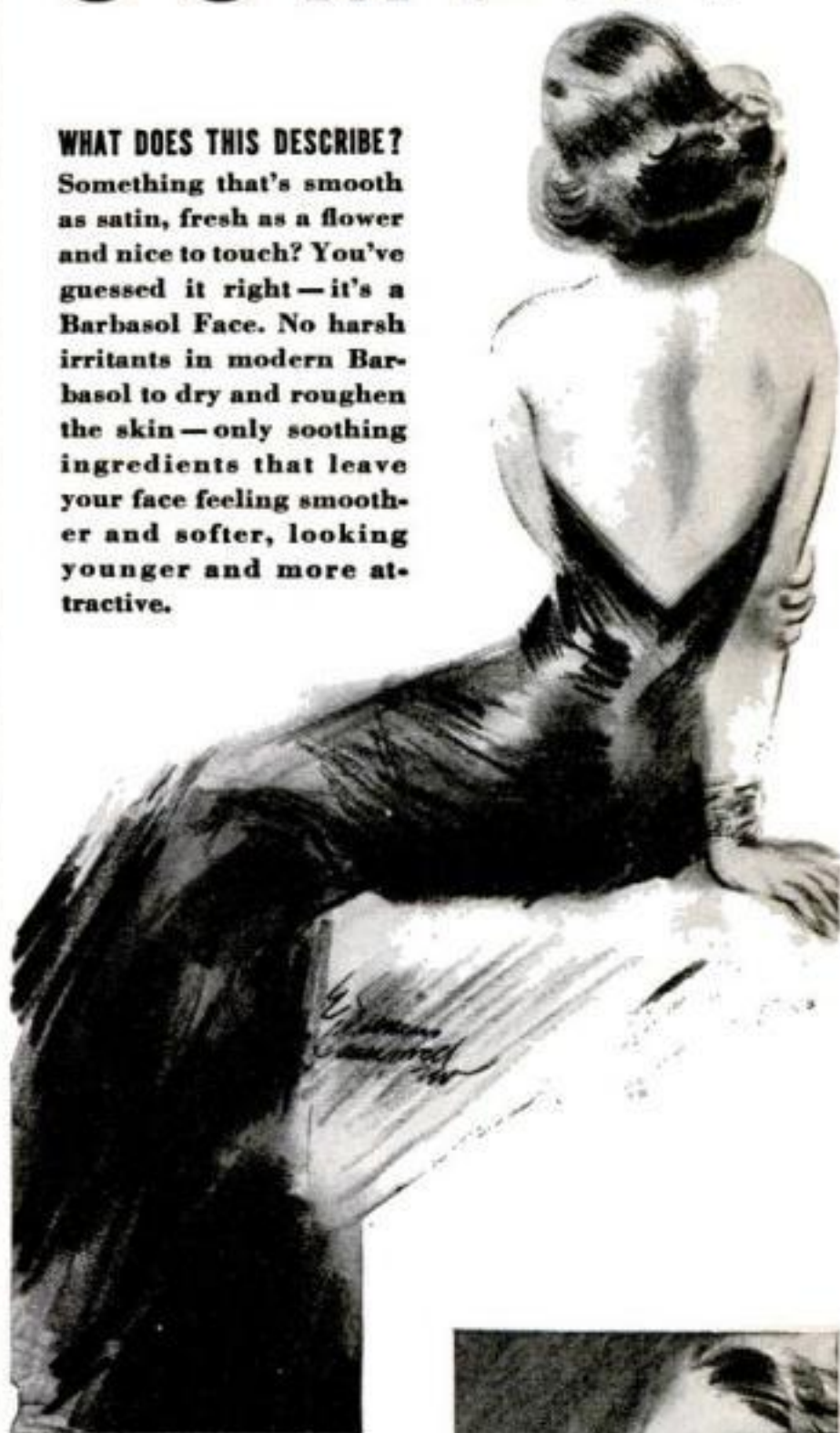
SPLENDID in blue and gold, a nine-plane "V" formation roared over Operations Headquarters; over the slate-blue ranks of undergraduate cadets standing at attention, and the crowd of spectators grouped around their automobiles. Flight by flight, the entire graduating class passed in review. An hour later, in the post auditorium, an Air Corps colonel concluded the address of the day:

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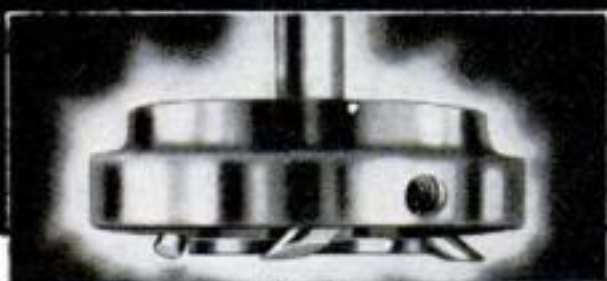


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World Sky Terminal

(Continued from page 64)

ends of all runways, supplemented by emergency stop lights. There too, huge numerals from 1 to 8 are painted on the ground. Thus, when a pilot is instructed to land on runway 5-8, for example, he quickly spots it from the air by its numbers, and in addition knows that he must approach it from the end marked 5.

All runways are interconnected by 100-foot-wide taxi strips, and intersections are equipped with traffic lights worked from the control tower. At one point on the field, several of these intersections are screened from the tower by hangar roofs. So at these spots, staggered, pneumatic treadles are sunk in the ground. When a plane taxis over them, lights flash in the tower, telling the operator not only where the plane is, but in which direction it is moving.

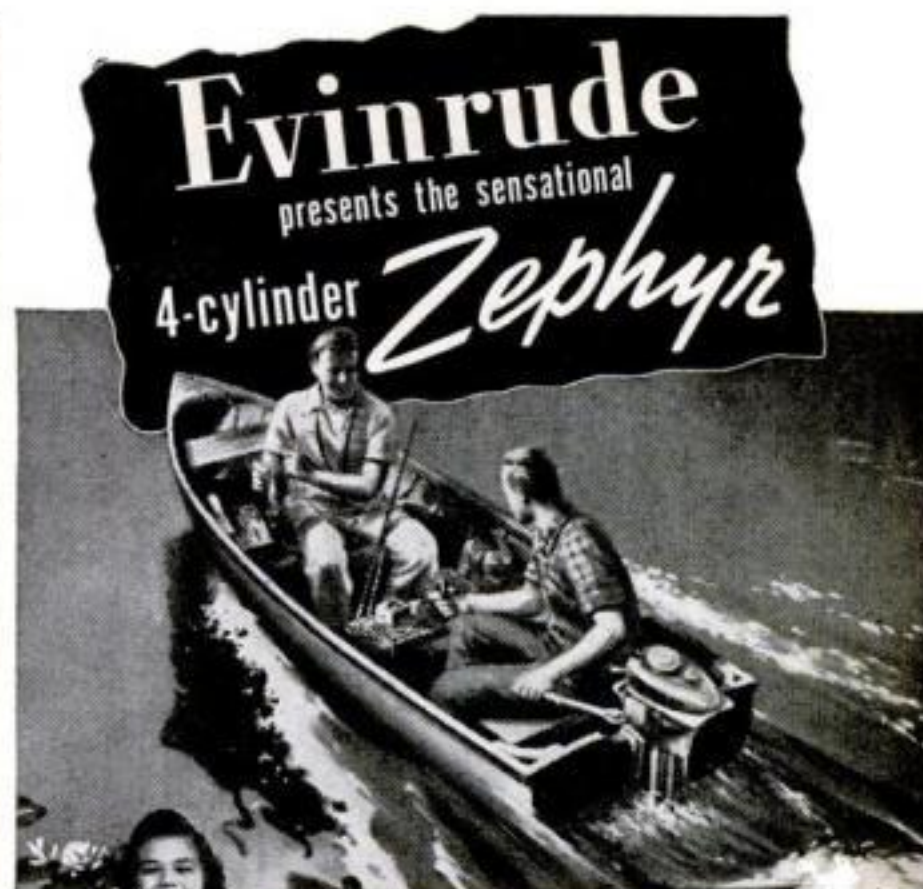
The handling of gasoline at La Guardia Field also is accomplished with speed and safety. Storage tanks holding 360,000 gallons—enough to fly an ordinary transport plane around the world more than forty times—are located a mile from the hangars which they serve through underground pipes leading to protected fueling pits. A special fire truck, equipped to spray flame-quenching chemicals, is on constant duty.

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LETTERS in the table below indicate the correct answers for the Question Bee on page 138. Check your results and give yourself five points for each one you had right. A total score of 75 to 85 is good; 90 or better is excellent.

1. d	5. b	9. c	13. e	17. c
2. b	6. c	10. b	14. c	18. d
3. d	7. a	11. a	15. a	19. b
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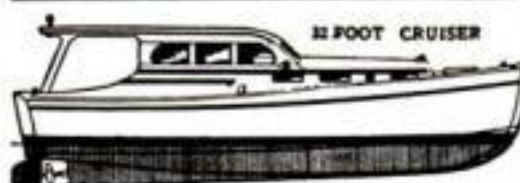
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Training Navy Divers

(Continued from page 101)

perience and ability increase, however, he carries down tools of the salvage trade, and learns to cut out rivets, drill, saw, calk seams, assemble pipe fittings, cut steel with acetylene and electric torches—carrying out all these jobs at constantly increasing depths. Through thick glass deadlights in the tank, his work is watched by his master-diver instructors, who make suggestions to him by telephone.

In addition to tank practice, divers are given experience in the Potomac River and about the docks of the Navy Yard, where they fasten loose piling, inspect ship bottoms and propellers, and retrieve lost articles. Occasionally they go to sea, where students are given actual practice in rigging pontoons, and in "rescuing" fellow seamen, by means of a diving bell, from a bot-tomed submarine.

Theory goes hand in hand with practical work. In a classroom adjoining the diving tank, students learn to compute air pressures necessary for divers at different depths, how fast hand pumps must be turned to get these pressures, how rapidly divers may rise to the surface from different depths without danger of the dread caisson disease, or "bends." Here they learn to give first aid, resuscitate drowning men, and use a Momsen lung. Close by, in an open tank, they learn to rig pontoons to a sunken submarine, using scale models to test their theories.

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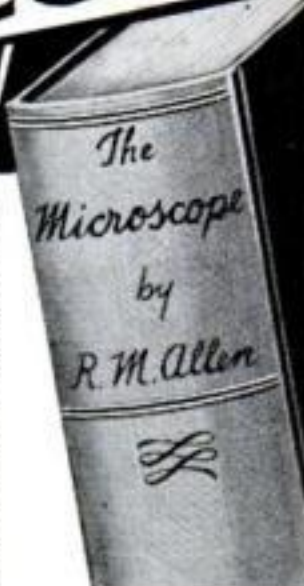
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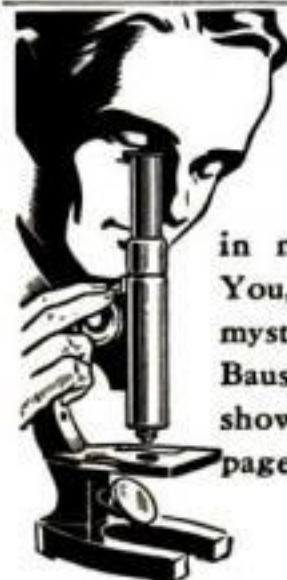
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Making "Solid" Pictures with Your Microscope

(Continued from page 208)

exposure is important, for too much or too little will introduce distortion. As a general rule, when the negatives are to be printed by contact, the amount of shift, as measured along a line parallel to the object plane and passing through the center of the film, is one twelfth the distance from the front of the object to the lens diaphragm. A little variation is not noticeable.

There are several methods of making stereo pictures through a microscope. Among these are shifting the object between exposures, so that the image shifts on the ground glass or film; changing the angle of the object with respect to camera axis, between exposures; using off-center stops behind the objective lens, and changing position of the substage mirror so that the angle of the light beam is altered, making the image appear to shift. Of these methods, the first two will be described.

Shifting the object is perhaps simplest of all. Assuming that you are using a 4" by 5" camera, focus the image for the first exposure so that the center of interest is toward one end of the ground glass. Make the exposure, and then move the slide along a line parallel to the longer dimension of the ground glass until the image has traveled approximately 2½". Then make the second exposure. Arrange a slide or mask for the film holder so that half of the film is covered during each exposure, the mask being reversed between shots, giving you both stereo pictures on one negative.

When you expect to enlarge the negatives in making prints, or if you use a miniature camera, make the shift proportionately less.

The system of tilting the object possesses the advantage, when making exposures on separate films, that the image remains in the same position. For the first exposure, one end of the slide is raised a slight amount above the stage. Then, for the next exposure, the other end is raised and the first end lowered to the surface of the stage. This can be accomplished simply by inserting a toothpick or match stick under the proper end of the slide. For more precise control, the device shown in the drawings can be made from sheet metal. The amount of tilt varies with the power of the objective, and should be more when the objective magnification is lower, less when higher.

For your first ventures into Stereoland via the microscope, be sure to select small objects that definitely have depth.

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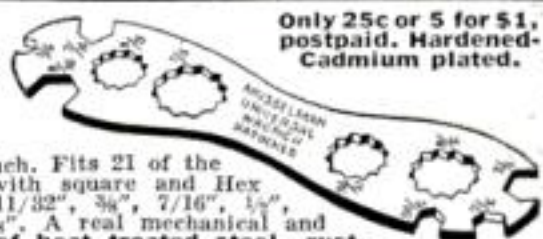
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How's It Made?

(Continued from page 211)

the tube, even after a wait of many hours.

In the first case, the particles of graphite were relatively large; in the second, the tannic acid aided in making them so small that they formed a colloidal suspension, or did not sink, in the water. Let lamplight shine through a pinhole in cardboard, and then through this colloidal suspension of graphite in the test tube. You will see a beam of light reflected from the suspended particles, a phenomenon known as the Tyndall effect. Pour the liquid through filter paper, and it will remain unchanged; the graphite particles are even tiny enough to pass through the pores of the paper.

The experiment just described may be varied in several ways. Either lampblack or aluminum oxide may be successfully substituted for the graphite. Instead of tannic acid, you can use other tanninlike materials, such as tea leaves or straw.

If you or your friends are amateur gardeners, you may have good use for a chemical powder that you can make, called red cuprous oxide. Great havoc is caused in greenhouses by the plant ailment called "damping off," in which small seedlings rot at the ground level and die. But if red cuprous oxide is dusted on the seeds, just before sowing, this will not occur.

To make red cuprous oxide, dissolve about fifty grams of copper sulphate (also sold as "bluestone" and as "blue vitriol") in 300 cubic centimeters of water. Combine this with another solution, made by dissolving about seventy-five grams of sodium potassium tartrate (Rochelle salts) in 300 cubic centimeters of water. A blue precipitate of a copper-tartrate compound will be formed. Warm, and add about 100 grams of ordinary cane sugar. This will convert the precipitate, within a few minutes, into red cuprous oxide.

Next, allow the precipitate and the solution to cool. Pour off the worthless solution above the red precipitate; add water; shake; and filter. While the precipitate is still on the filter paper, wash it well with hot water, to remove soluble chemicals adhering to it. Then open up the filter paper and let the precipitate dry in a warm place. The red cuprous oxide can now be scraped off the filter paper, and is ready for use.

Do not confuse this red cuprous oxide with black cupric oxide, which is obtained by heating copper nitrate. Both contain copper and oxygen, but in different proportions; and the chemical behavior of the two

(Continued on page 245)

How's It Made?

(Continued from page 244)

compounds would be found quite different.

Beauty parlors use a different kind of chemical trick, whose principle you can demonstrate, for what is called a machineless permanent wave. In this process, strands of hair to be curled are wrapped around a rod, and are wrapped in turn by a small moistened pad. This self-heating pad emits warmth for twenty minutes or so, during which time the moisture and heat impart a curl to the hair.

A typical pad of this kind contains several layers of aluminum foil. It is moistened with a chemical solution that will react with the aluminum and dissolve it, releasing heat in the process. In theory, a weak solution of sodium hydroxide (lye) would work, but in practice it would be crude and dangerous. Among practical formulas, a simple one consists of about fifteen grams of potassium chlorate, or of sodium chlorate; three grams of copper sulphate; half a gram of aluminum sulphate; and half a gram of ammonium chloride. These chemicals are dissolved in thirty cubic centimeters, or about a fluid ounce, of water.

You can actually watch the chemical reaction that produces the heat, if you make up this solution and pour it upon a wad of aluminum foil in a test tube or beaker. (The metal foil wrapped around films and candy bars is aluminum, and will serve if it is not too greasy.) You will feel the solution warm up, and see the aluminum foil becoming coated with a brown film of metallic copper. This free copper comes from the copper sulphate, and is displaced from its compound by the aluminum.

Each of the other ingredients has its purpose. Natural acidity in the solution of the aluminum sulphate starts the reaction going. Because of its oxygen content, the chlorate acts as a "depolarizer," and keeps the reaction from slowing down by oxidizing any film of hydrogen on the aluminum foil. This maintains contact between the surface of the aluminum and the chemical solution. The ammonium chloride helps control the rate of progress of the reaction, by regulating the acidity of the solution, although its use is not essential.

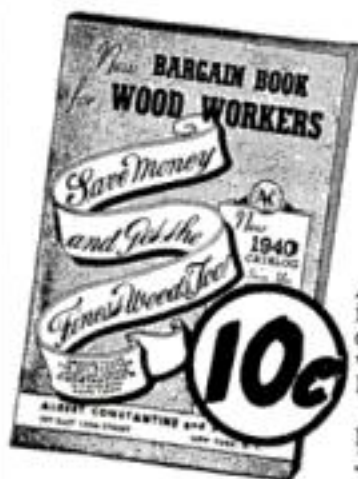
You can visualize the production of heat, in the reaction just described, by soaking a sheet of paper with cobalt chloride solution and drying it in the air. If the beaker containing the reacting foil and solution is placed upon it, heat from the reaction will turn the cobalt chloride paper a deep-blue color.

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MEN LIKE YOU are making Big Money

in the Patented-Protected, Nationally Advertised

NEW ART Cleaner Business

Men with a mechanical slant have made thousands of dollars with the automatic, self-wringing NEW ART Cleaner that scrubs, sweeps and mops.

Some of the Many Records—"Averaging 75 sales a week," writes Mr. Mulligan of Iowa. "Sold 11 NEW ART Cleaners in seven hours," reports Mr. Miller of Pa. "Out of 11 demonstrations in one day, made nine sales," says Mr. Brown of R. I. "Sold nine Wednesday, nine today," writes Mr. Schroeder of Mich.

What Others Have Done—You, Too, Can Do!

Today, national advertising of the NEW ART Cleaner in leading Women's Magazines as well as recommendations by hundreds of thousands of

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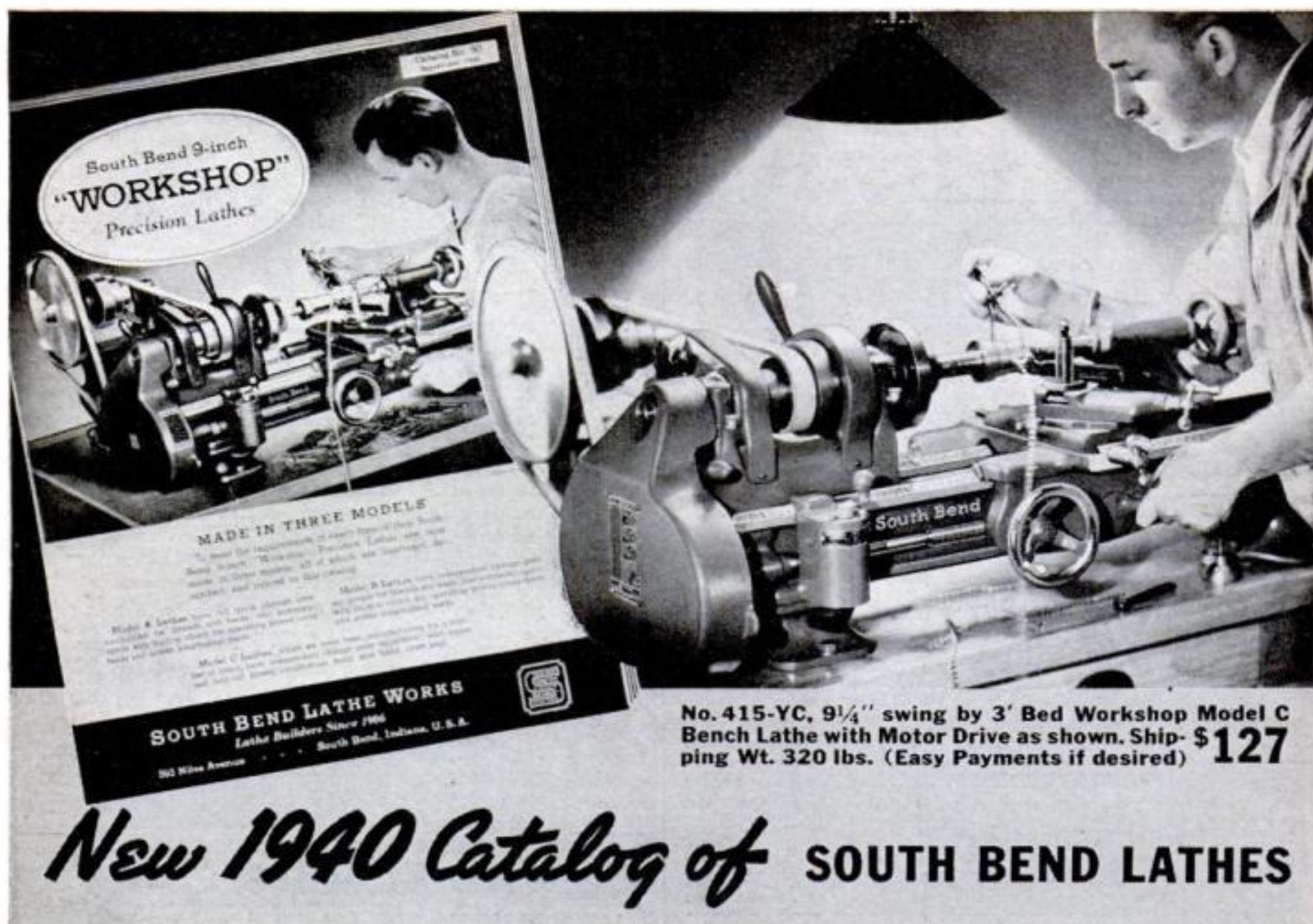
Start full or part-time. But don't delay. Your BIG opportunity is HERE! NOW! Write today for full information.

ARTMOORE COMPANY

Dept. SC-30, 108 N. Water Street, Milwaukee, Wis.



Self-Wringing. Hands never touch water.
Pat. Nos. 2008615, 2108727
Other Pats. Applied for.



South Bend 9-inch
"WORKSHOP"
Precision Lathes

MADE IN THREE MODELS

SOUTH BEND LATHE WORKS
Lathes Built Since 1906
362 N. Main Avenue South Bend, Indiana, U. S. A.

No. 415-YC, 9 1/4" swing by 3' Bed Workshop Model C Bench Lathe with Motor Drive as shown. Ship- \$127
ping Wt. 320 lbs. (Easy Payments if desired)

New 1940 Catalog of SOUTH BEND LATHES



SIX SIZES of SOUTH BEND LATHES

Manufactured in 9", 10", 11", 13", 14 1/2" and 16" swing, in 3' to 12' bed lengths. Motor Drive or Countershaft Drive, Quick Change Gear or Standard Change Gear type. Prices range from \$95 to \$1500.

THIS new 48-page catalog describes the 1940 line of South Bend 9-inch Workshop Lathes. Twenty-three different models are listed at prices from \$115 up, complete with drive equipment.

Improved engineering features of the new 1940 model lathes include quick change gear equipment making all power feeds and threads instantly available at the touch of a lever and an automatic apron with friction clutch drive for power cross feeds and power longitudinal feeds.

Attachments, chucks and tools for production manufacturing, precision tool room work, general machine work and automotive service machine work are also listed in this catalog.

**SOUTH BEND LATHE WORKS, 844 E. Madison St.
South Bend, Indiana, U. S. A.**

Write **FOR YOUR COPY TODAY**

A copy of this new 9-inch Workshop Lathe Catalog will be mailed on request. Use the Coupon or a post card. State size of lathe best suited to your work.

Free!
**TO SHOP
MEN**

SOUTH BEND LATHE WORKS

844 E. Madison St., South Bend, Indiana, U. S. A.

Please send me Free your New 1940 Catalog of South Bend Lathes.

Size of Lathe _____

Name _____

Address _____

City _____ State _____



SOUTH BEND Precision LATHES

GENUINE NEWEST IMPROVED
UNDERWOOD NO. 6
 1/2 MFRS. ORIG. PRICE!

NO MONEY DOWN Sale!
I trust you on 10 DAY TRIAL
EASIEST TERMS Only 10¢ a day

**BUY DIRECT
 FROM ME AND
 SAVE OVER 1/2!**



My direct-to-you plan brings you this latest improved Underwood No. 6 at a NEW SENSATIONAL LOW PRICE—less than 1/2 the mfrs. orig. price! Pay no money down—try this marvelous Underwood for ten days with no obligation to buy—then use the easiest payment terms yet. Because I deal direct and have no salesmen or expensive branch offices—I pass BIG SAVINGS on to you!



**LATEST
 MODEL
 No. 6**

**MONEY-BACK
 GUARANTEE**

We not only guarantee that your typewriter will reach you exactly as represented but guarantee it to be satisfactory in every respect.

**NEWEST No. 6 STANDARD OFFICE SIZE
 with MODERN IMPROVEMENTS**

Over 200,000 buyers paid \$110.00 cash for this marvelous Improved latest model Underwood No. 6, but it's yours—with all its modern features for only \$39.90 (cash). Think of it—you save over \$70.00! Do not confuse this fine late Model rebuilt Underwood No. 6 with old, inferior models or low priced portables. This Underwood No. 6 is the MASTER DE LUXE MODEL with many new innovations—at an amazing rock-bottom price. The most sensational Typewriter Value of all time! It has Non-Glare Standard Keyboard, 2 shift keys, 5 tabulator keys, margin release key, variable line spacer, stencil cutting device, plus many other late improvements. An all purpose model for all-around business and social use. Fully guaranteed by me.

**NO MONEY DOWN — Try This Underwood
 AT MY RISK FOR 10 FULL DAYS!**

I mean it! I will ship you this wonderful No. 6 Underwood at my own risk so you can try it in your home or office. You are the sole judge. Don't pay one cent down—no obligation to buy. Could any offer be fairer?

EASIEST TERMS IN OUR HISTORY

When you have tried this De Luxe Model Underwood No. 6—when you have convinced yourself it is the biggest bargain ever offered—then and only then say, "I'll keep the Underwood." Use the easiest terms yet—as little as 10c a day—only \$3.00 a month.

**OVER 200,000 SATISFIED CUSTOMERS
 HAVE BOUGHT DIRECT FROM ME!**

Through my direct-to-you Golden Rule Policy, I have served over 200,000 customers all over the world. Buy with confidence and assurance on my money-back guarantee, backed by over one quarter million assets.

HURRY—Limited Quantity on this Sale!

**INTERNATIONAL TYPEWRITER EXCHANGE
 231 W. Monroe St., Chicago, Ill.**

**YOURS
 FREE!**

**ROLL-AWAY
 SECRETARIAL
 TYPEWRITER
 STAND!**

**YOURS ABSOLUTE-
 LY FREE with this
 late Model Under-
 wood No. 6. Makes your
 typewriter portable.**

Ask for details.

FREE



Two metal wings — correct working height.

Mounted on casters, can be moved by touch of finger. Sturdy, compact, weighs but a few pounds.

Big working surface. All metal, compact, strong, quiet, rigid, attractive.

COMPLETE TOUCH TYPING COURSE

FREE ... a complete 9 lesson Home Study course of Famous Van Zandt Touch Typing system with your Underwood. Get details now—(Limited quantity at this price and no more when they're gone.) Send coupon for FREE Catalog showing Underwood (and other standard makes) in Full Colors. Also Bargain Prices and 10-day Trial Offer. Don't buy a typewriter anywhere before you have seen this catalog with new rock-bottom prices!

**MR. W. F. CLAUSING, PRESIDENT
 INTERNATIONAL TYPEWRITER EXCHANGE**

Special Und. No. 6

231 W. Monroe St., Chicago, Ill., Dept. 307
 Please send WITHOUT OBLIGATION complete illustrated catalog in colors showing Special Offer UNDERWOOD No. 6 and other sensational typewriter bargains. Also special 10-day trial—no money down offer with Free Stand.

Name
 Address
 Town State

"I GET

EXTRA
MILDNESS

EXTRA
COOLNESS

EXTRA
FLAVOR

in slower-burning
Camels," says Bill Corum,
famed sports writer
and columnist



SURE
I WORK FAST—
BUT I LIKE MY
SMOKING SLOW.
MILDER, COOLER
CAMELS ARE CHAMPS
WITH ME



LIGHTNING-FAST in the press-box. Why, Bill Corum's been known to file 3,000 words of copy during a single big sports event. But no speed for him in smoking—slower-burning Camels are Bill Corum's cigarette.

And here's Bill at work in the quiet of his office. Bill . . . typewriter . . . books . . . pictures . . . and Camels—slow-burning Camels. "I find them milder and cooler—and thriftier," he says.

Copyright, 1940, R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

BILL CORUM'S sports news isn't just printed...it's *sprinted*...at lightning speed from press-box to press and the Five-Star Final. But when the candid camera catches Bill in his office with a cigarette—well, "No speed for me in my smoking," he says.

His own common sense and smoking experience tell him what scientists have found out in their research laboratories—that "slow-burning cigarettes are extra mild, extra cool, fragrant, and flavorful."

Cigarettes that burn fast just naturally burn hot. And nothing

so surely wrecks the delicate elements of flavor and fragrance in a cigarette as excess heat. No wonder you get a hot, flat, unsatisfactory smoke.

The delightful mildness, coolness, fragrance, and flavor of Camels are explained by this important finding—Camels proved to be the *slowest*-burning cigarette of the sixteen largest-selling brands tested! (The panel at the right explains the test.)

So take a tip from Bill Corum—and find out for yourself how Camels give you more pleasure.

In recent laboratory tests, CAMELS burned 25% slower than the average of the 15 other of the largest-selling brands tested—slower than *any* of them. That means, on the average, a smoking *plus* equal to



5 EXTRA
SMOKES
PER
PACK!

MORE PLEASURE PER PUFF... MORE PUFFS PER PACK!

Camels—the cigarette of Costlier Tobaccos